Feasibility of Full-Time Commuter Rail Service to the Fenway/Kenmore Area

- It may be feasible to build an 800 foot, high-level platform station on only the South track between Beacon Street and Brookline Avenue, if a crossover added to minimize impacts on freight operations is acceptable to CSX.

- Ridership estimates assume MASCO run shuttle service between full-time Yawkey Station and the Longwood Medical Area (LMA).

KEY FINDINGS CONCERNING FULL-TIME COMMUTER RAIL SERVICE TO FENWAY/YAWKEY AREA

Issue	Finding
System-wide Ridership	• New service would yield few net new transit riders (339 in 2001).
Study Area Ridership	• Would increase study area transit ridership by 685 riders per day in 2001.
Impact on Existing MBTA Services (Year 2001)	• Would add 2 to 3 minutes to 20,000 daily commuter rail trips. • Would lose 346 current Worcester/Framingham customers. • Would divert 568 trips from rapid transit to commuter rail. • Could marginally decrease reliability of commuter rail service.
Impact on MBTA Operating Expenses (Year 2001 estimates)	• Gross annual passenger revenue estimated at $815,000. • Annual operating cost estimated at $652,000. o Operating cost estimates include cost of MASCO shuttle. o Operating cost estimates do not include debt service expenditures.
Capital Costs	• $14.3 million (in 1999 dollars) for high-level platform, crossovers, additional coaches and increased parking in western suburbs. • Costs for debt service to retire capital expenditures are not included in analysis.
Reverse Commuting	• New service would not materially improve access to suburban jobs.
Compatibility with Other Transportation Initiatives	• Project is compatible with other public transportation projects and studies underway including: Kenmore Improvements, Urban Ring Major Investment Study, Green Line Operations Study, Fenway Interim Planning Overlay District Study, Fenway-South Station Commuter Rail Shuttle Feasibility Study.
Freight Access	• Expanded commuter rail service may impact freight operations.
Residents/Neighborhoods	• Station adjacent to highway would not affect amenity of the area. • Station centered between Brookline Avenue and Beacon Street would compliment adjacent land use. • Creates a new transportation node used by approximately 1,200 persons daily, and strengthens the Fenway/Kenmore area as an urban center.
Study Area Accessibility	• Enhanced access to Fenway/Kenmore study area from western suburbs. • In1990, the potential market was estimated to include almost 4,000 daily commuters.
Study Area Traffic and Parking Demand (Year 2001)	• Eliminates 457 – 527 automobiles from daytime traffic on local streets/parking lots. • Impact on evening and weekend parking demand near the proposed baseball complex is negligible.
Longwood Area Traffic and Parking (Year 2001)	• Would increase transit use to the LMA by 500 daily commuters. • MASCO would need to shuttle up to 1,000 commuters to and from the new station to include the LMA commuters who now ride the Green/Orange Lines.

Recommendations

The proposed new service appears attractive, but before committing to the project the MBTA should obtain:

- More detailed analysis on physical constraints and construction costs.
- A firm commitment on shuttle services from the Longwood Medical Area.
- Commitment of the necessary capital funds.
- Concurrence from CSX Corporation.
- An environmental analysis, if found to be required.

KKO

June 5, 2000

Feasibility of Full-Time Commuter Rail Service to the Fenway/Kenmore Area

Table of Contents

FEASIBILITY OF FULL-TIME COMMUTER RAIL SERVICE TO THE FENWAY/KENMORE AREA

Introduction

This report was prepared for the Massachusetts Bay Transportation Authority's Planning Department to document the methods and findings of the feasibility study of full-time commuter rail service to the Fenway/ Kenmore area of Boston on the Worcester/ Framingham commuter rail line.

MBTA Goals and Objectives

1. Evaluate the physical, operational and financial feasibility of full-time commuter rail service to the Fenway/Kenmore Area which would:
    - Minimize impacts on existing MBTA customers and services
    - Minimize potential for conflict between freight and passenger rail services
    - Maximize service to a new full-time station

2. Determine likely impacts on:
    - Other MBTA projects
    - Rail Freight Service
    - Massachusetts Turnpike Authority
    - Study Area Residents
    - City of Boston
    - Longwood Medical Area
    - Study Area Land Use
    - Boston Red Sox

Other MBTA Projects: Expanded commuter rail service to the Fenway/ Kenmore area should consider and not preclude other MBTA projects, either currently planned or under evaluation, such as: proposed Urban Ring Major Investment Study alternatives, modifications to the Green –

Line Kenmore Square Station and associated surface improvements, Green Line operational improvements, additional commuter rail stations between Framingham and Worcester, and a potential Fenway to South Station rail shuttle.

Rail Freight Service: Expanded commuter rail service to the study area could affect freight service in two ways. First, a high-level platform at a new station would reduce flexibility for the movement of wide loads. Second, changes or increases in the schedule of passenger trains could impact CSX's ability to schedule and operate freight trains. CSX would be willing to consider a high-level platform on a single-track at the new station if certain improvements, such as a crossover between the Yawkey Station site and Back Bay Station, were made in the area.

The Massachusetts Turnpike owns the land occupied by the commuter railroad, Yawkey station and the nearby parking lots. The Turnpike is very interested in developing the land that is currently used for parking and promoting development on air rights over the rail/highway corridor in the vicinity of Yawkey Station.

Study area residents are very concerned about the quality of life in their neighborhoods and would like to explore strategies where the adverse impacts of the nearby baseball park, hospital research complex, university, and interstate highway are reduced or minimized.

The City of Boston has encouraged the Red Sox to build a proposed new ballpark in the Fenway area. The City of Boston is interested in managing growth pressures, while improving urban form and livability by exploring expanded service to the Fenway/Kenmore area. The City sees a commuter rail station developed in conjunction with air rights and related developments as a potentially constructive supporting service.

The Longwood Medical Area (LMA) is adjacent to the Fenway neighborhood. The Longwood Medical community is a large regional employer with considerable pressure to provide improved transportation and parking to its employees. It currently operates MASCO (Medical Academic and Scientific Community Organization, Inc.) shuttle bus service to parking lots adjacent to Yawkey station, and is very interested in meeting commuter rail trains at the same site if service is expanded to the Fenway/Kenmore area.

Study Area Land Use: The study area is growing as a center for educational, medical and commercial activity. Boston University (BU) is west of the current Yawkey Station and is interested in expanding its campus in the air rights over the Turnpike. BU supports expanded rail passenger service to the study area as long as it does not interfere with BU development plans. In the Fenway area, the Landmark Center and Boylston Square forecast several million square feet of office, retail and residential growth in the next few years. Longwood Medical Area institutions have also recently announced plans to build several new buildings to handle increased office and clinical demands. There are plans for a 200,000 square foot hotel at Kenmore Square.

The Boston Red Sox ball game traffic triggers substantial roadway congestion and parking competition. With a proposed 30% expansion for the new ballpark, the Red Sox hope that improved transit accessibility to the Fenway area can mitigate traffic impacts of the development.

Background

Study Area

The Fenway/Kenmore area is located approximately two miles west of downtown Boston. The area includes both a major employment center for medical, office and educational employment, and residential neighborhoods. The project's transportation market analysis area is 0.8 square miles including Kenmore Square, the Fenway area and the Longwood Medical Area north of Huntington Avenue.

43,000 persons work in the study area.
28,000 persons live in the study area.

In the next twenty years, study area employment is expected to increase by 25% to nearly 54,000 jobs.

Figure E.1: The study area outlined in red

Current Commuter Behavior

According to the 1990 US Census of Journey to Work and the 1993 MBTA Commuter Rail Passenger Survey, most persons working in the study area commute by private automobile. One quarter used local buses and the Green Line. Only 2% use commuter rail as a part of their daily commute.

Table E.2

Mode of Travel for Study Area Employees		
Mode	**All Study Area Workers**	**Residents of Worcester/Framingham Corridor Only**
Drive Alone	43%	68%
Carpool/Vanpool	10%	11%
Bus and Rapid Transit	25%	16%
Walk	17%	0%
Commuter Rail	2%	4%
Other	3%	1%
TOTALS	**100%**	**100%**
Numbers of Workers	43,218	3,853

Source: US Census: Journey to Work: 1990

Approximately 4,000 study area employees living in the Worcester/ Framingham corridor could potentially be served by full-time commuter rail service to the Fenway/Kenmore area. Currently, two out of three of these employees drive to work alone, and only four percent use commuter rail as a segment of their commute.

Table E-1:
Feasibility of Full-Time Commuter Rail Service to the Fenway/Kenmore Area
Summary and Discussion of Transportation Objectives

Project Objective	Discussion
1. Improve overall non-highway accessibility to study area	Would enhance access to study area from the Framingham/Worcester Corridor, particularly from communities such as Natick, Framingham and points west.
2. Reduce overall traffic and demand for parking in the study area	Would eliminate approximately 525 automobiles per day from local streets and parking lots.
3. Reduce impacts of enlarged stadium	Decreases in demand for evening and weekend parking would be negligible.
4. Strengthen Fenway/Kenmore area as an urban activity center	Would create a new transportation focal point in the area that would be used by approximately 1,200 persons per day.
5. Avoid project impacts on study area residents.	Eastern site for main line station would have lower noise, visual and pedestrian impacts on residential areas west of Beacon Street.
6. Support air rights development over the turnpike	Would create a new transit activity node that would increase accessibility and attractiveness of any developments overhead.
7. Reduce traffic congestion and parking demand at Longwood Medical area	Most workers attracted to use the new direct service from Framingham and Worcester would be Longwood Area Employees. Approximately half would be commuters who would otherwise use the Green Line. LMA would need to provide bus shuttle service for up to 1000 employees to divert no more than 500 employees to transit.
8. Manage growth pressures in the study area while improving urban form and livability	Would make study area more accessible to approximately 4,000 commuters from the west and increase potential for growth as an employment destination.
9. Maintain rail freight access to South Boston	Station expansion with a single-track station and appropriate track crossovers would not have a substantial impact on rail freight access to South Boston.
10. Improve rail freight operations in Boston	Universal crossover east of Brookline Avenue routing most commuter trains onto Track Two could increase freight flexibility in the vicinity of Allston yards.

Existing Public Transportation

The study area is served by all branches of the MBTA's Green Line and by twelve MBTA bus routes, some of which provide service to the Orange Line and Green Line.

- The bus service is primarily oriented toward relatively short local trips.
- All of the direct MBTA transit service to the study area originates within the Route 128 ring.
- There are no express commuter services from the western suburbs.
- Nearly one third of all the area bus passenger trips both originate and terminate in the study area.

Approximately 60,000 daily MBTA transit trips start or end in the study area.

- There are approximately 17,000 daily boardings at key Green Line stations (Kenmore, Fenway, Longwood, Brigham Circle, and Longwood Medical Area).
- Daily bus boardings in the study area equal 13,188.

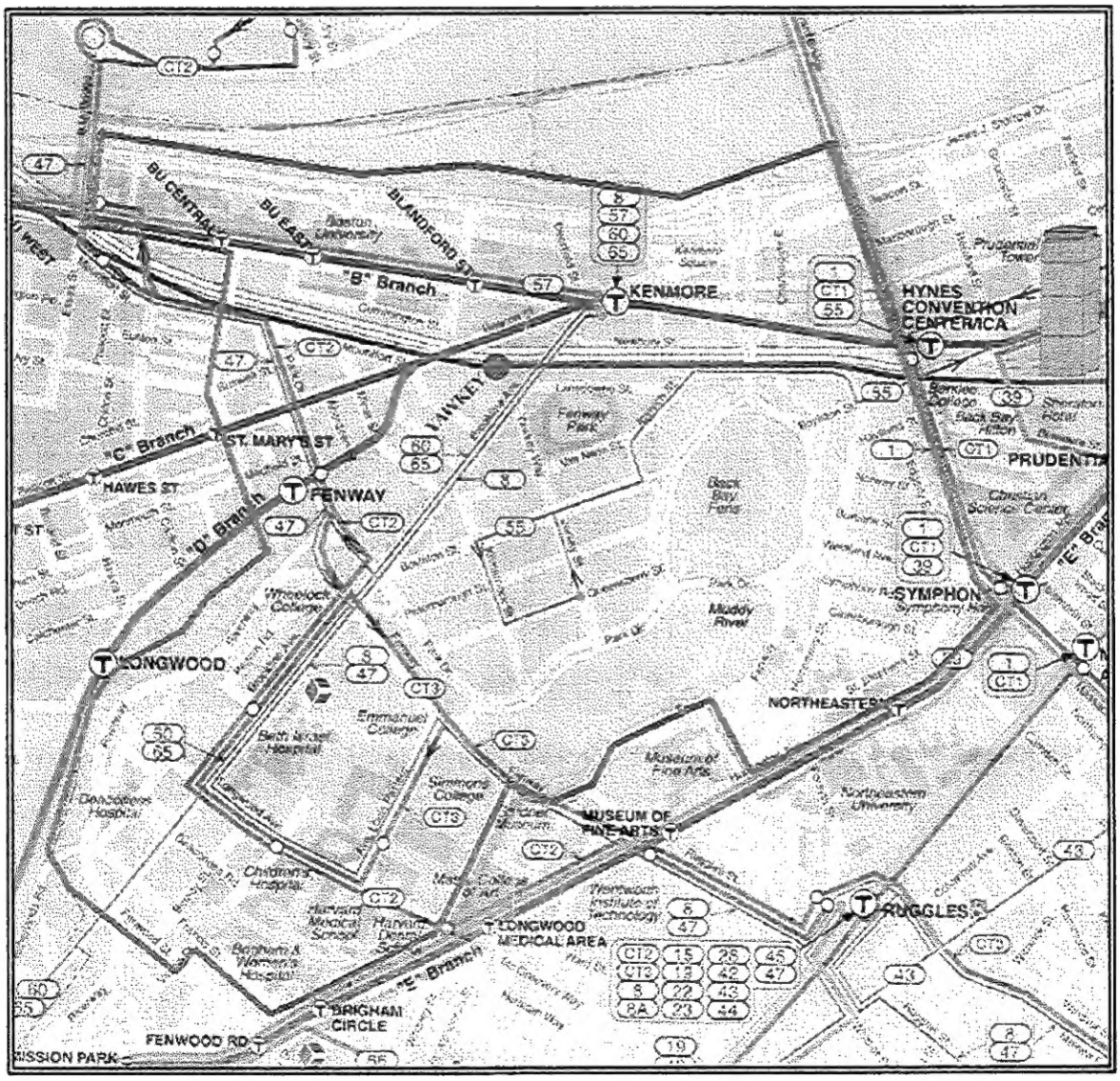


Figure E.2: MBTA transit network in the study area

Physical Feasibility

Constraints

1. Avoid realigning track.
2. Avoid conflicts with overhead bridge abutments and the Turnpike.
3. Avoid land takings.

Existing Conditions

- Two-track railroad in the study area shares right of way with the Massachusetts Turnpike to the north.
- Current special event commuter rail service at Yawkey Station serves only the south track. The platform can accommodate only two coaches.
- Right of way in study area is crossed by three roadway overpasses
  - Brookline Avenue
  - Beacon Street
  - Saint Mary's

Figure E.3: View from existing Yawkey Station looking East towards Boston.

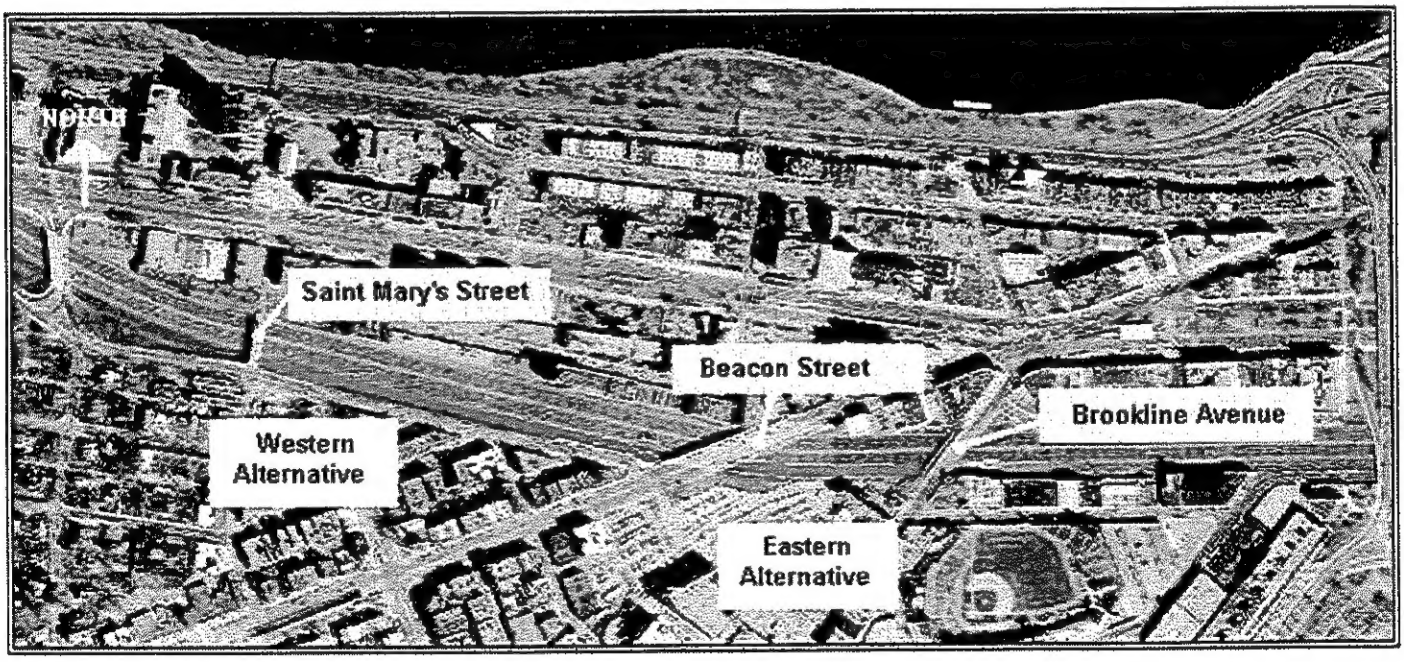


Figure E.4: Rail Corridor Detail
Track segment where a station platform is physically feasible is highlighted.
Major overpasses are labeled.

Findings

Two alternative station locations were considered. (See Figures E.4, E.5 and E.6)

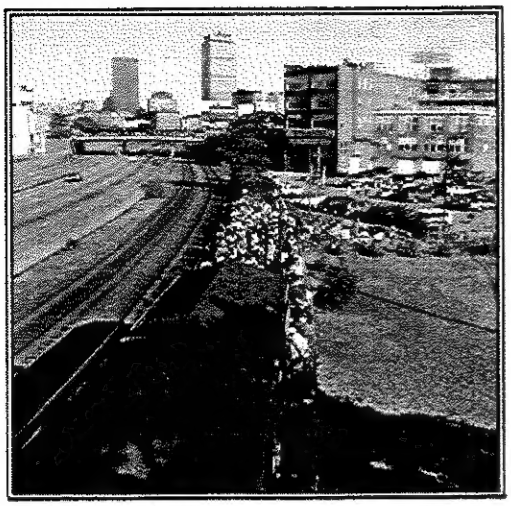


Figure E.5: Eastern Alternative: Between Brookline Avenue and Beacon Street

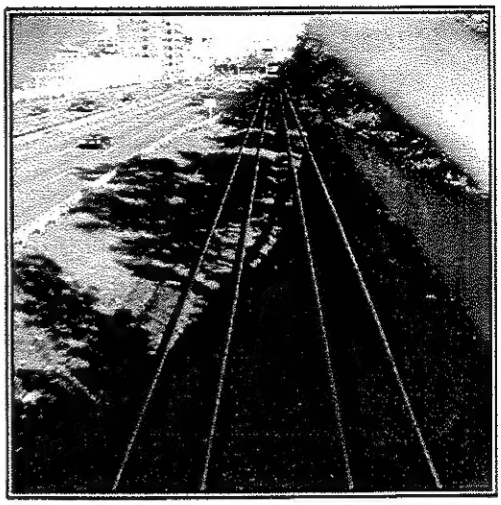


Figure E.6: Western Alternative: Between Saint Mary's Street and Beacon Street

Informal inspections of the right of way and consultations with MBTA engineers indicate:

North Track

- There is no room to build a platform east of Brookline Avenue without encroaching on the Turnpike or realigning track.
- There may be room to build a platform for the western alternative station location.

South Track.

Cannot build a station platform east of Brookline Avenue without a land taking.

- Cannot build a station platform under Brookline Avenue due to conflict with bridge abutment.
- Can build a platform for the eastern station location between Beacon Street and Brookline Avenue.
- Can build a 6 - 8 foot platform under Beacon Street for the eastern station location.
- Can build a platform at the western station location.

Formal site surveys and more detailed engineering should be conducted to confirm the findings of the informal inspections

Surrounding Neighborhood

Area east of Beacon Street is reasonably well suited for development as a railway station and preferred over the western alternative location due to:

- Relation to major transit nodes – closer to Kenmore Square.
- Compatibility with adjacent land use – mostly commercial, office and institutional.
- Impact on sensitive receptors – more remote from homes and residences than the western location.
- Ease and cost of construction:
  - No existing structures conflict with construction.
  - Most required land is in public ownership.

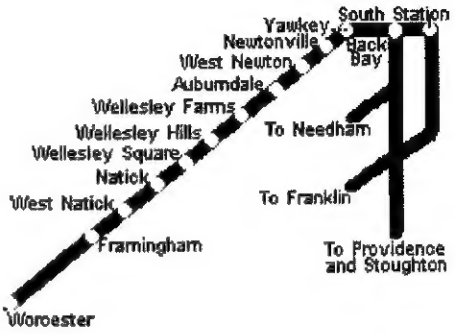
Conclusion
It is feasible to build an 800-foot, high-level platform single-track station on the south track west of Brookline Avenue. The platform would be narrower than standard where it passes beneath the Beacon Street Overpass, but should be usable.

Operational Feasibility

Existing Conditions
The Fenway/Kenmore area is on the MBTA's Worcester/Framingham commuter rail line. The line is served by 37 daily MBTA trains with 8,000 daily inbound boardings.

Within the next few years, the service will likely grow to 42 daily trains and 10,000 daily inbound boardings.

In the study area, the line belongs to the Massachusetts Turnpike Authority.



WORCESTER/ FRAMINGHAM LINE

CSX Corporation has freight trackage rights over the line and is responsible for maintaining and dispatching the line. Beacon Park Yard is Boston's busiest freight yard, and is the destination for all CSX traffic to Boston.

Findings
- A single-track station could be served by all regularly scheduled peak and off-peak trains.
- Reverse peak service could not be offered with only a single-track station.
- Adding a station stop less than two miles west of Back Bay Station would add up to three minutes to every rail journey between downtown Boston and the western suburbs.
- MASCO shuttle buses must meet every train for transport to the medical area.
- Measures are required to protect service reliability with a single-track station including a crossover east of the station.
- A high-level platform is required.
- CSX was consulted on the potential operational change.
  - CSX is concerned about clearance for wide freight loads and impacts on freight traffic from the west.
  - CSX might allow a high-level platform on one track at this station if crossovers allowed CSX to run around the horizontal clearance restriction.

Conclusion
With a crossover between Back Bay and a new high-level platform station only on the south track, it might be feasible to offer peak and off-peak commuter rail service to the Fenway/Kenmore area, and allow CSX to carry freight service on the north track. The new station stop would add two to three minutes to travel time for all other commuter rail trips on the line.

Financial Viability

Year 2001 Ridership Estimates

Table E.3

Commuter Rail Ridership to the Fenway/Kenmore Area (Year 2001)	Totals
Total Passengers using proposed new station each morning	1,253
Diverted Passengers from other MBTA services a. Travelers from western suburbs who used a combination of commuter rail and either the Orange or the Green Line to reach the study area (288) b. Travelers from the western suburbs who had parked at a Green Line station and taken light rail to the study area (114) c. Local travelers from the study area to the South Station area who had been traveling by the Green and Red Lines. (166)	(568)
NET NEW TRANSIT RIDERS TO THE STUDY AREA	685

Adding travel time between South Station/Back Bay Station and the western suburbs will divert 346 commuters away from commuter rail to automobile travel.

Table E.4

Ridership Adjusted for System wide Impact (Year 2001)	Totals
NET NEW TRANSIT RIDERS TO THE STUDY AREA	685
Commuter rail riders to downtown diverted to automobiles due to increased travel times on commuter rail	(346)
NET NEW TRANSIT RIDERS SYSTEM WIDE	339

Automobiles diverted from study area streets: 457 to 527

Year 2001 Revenue Estimate

Forecast of increase in total MBTA passenger revenue is $815,000.

Cost Estimates

Operating

- Operating costs for full-time service include MBTA expense for maintenance for the new facilities, additional coach miles for added riders, train crew for added coaches and fuel for the extra stop.
- Operating costs include estimate of MASCO expense for shuttle bus service.
- Estimated year 2001 operating cost is $652,000

Capital

- $14.3 million in 1999 dollars for a single-track high-level platform station with required crossovers, additional coaches and increased parking in western suburbs.

Conclusions

- The proposed service would generate $163,000 in annual revenues net of MBTA and MASCO operating expenses based on Year 2001 ridership estimates.
- The net revenue would not be sufficient to attract private funds to make the required investment.

Table E.5

KEY FINDINGS CONCERNING FULL-TIME COMMUTER RAIL SERVICE TO FENWAY/KENMORE AREA	
Issue	**Finding**
Systemwide Ridership (2001)	• New service would yield few net new transit riders. (approximately 339 daily in year 2001).
Study Area Transit Ridership	• Would increase 2001 study area transit ridership by 685 riders per day.
Impact on Existing MBTA Services (Year 2001)	• Would add 2 to 3 minutes each way to commuter rail trips for 10,000 current users of the Worcester/Framingham service. • Would cause 346 current Worcester/Framingham customers to stop using MBTA services. • Would divert 568 trips from rapid transit to commuter rail. • Could marginally decrease reliability of commuter rail service.
Freight Access	• Expanded commuter rail service may impact freight operations.
Impact on MBTA Operating Expenses (Year 2001 estimates)	• Gross annual passenger revenue estimated at $815,000. • Operating cost estimated at $652,000 (including MASCO). • Net operating revenue is $163,000 annually.
Study Area Accessibility	• Enhanced access to Fenway/Kenmore study area from western suburbs. • Based on the 1990 US Census, the potential market is estimated to include approximately 4,000 daily commuters.
Reverse Commuting	• New service would not materially improve access to suburban jobs.
Study Area Traffic and Parking Demand (Year 2001)	• Eliminates 457 to 527 automobiles from daily traffic on local streets and from the area's parking lots. • Impact on demand for evening and weekend parking near the new stadium is negligible.
Residents/Neighborhoods	• Station adjacent to highway would not affect amenity of the area. • Station centered between Brookline Avenue and Beacon Street would compliment adjacent land use.
Longwood Area Traffic and Parking (Year 2001)	• Would increase transit use to the LMA by 500 daily commuters. • MASCO would need to shuttle up to 1,000 commuters to and from the new station to include the LMA commuters who now ride the Green and Orange Lines.
Land Use	• Creates a new transportation node used by approximately 1,200 persons daily, and strengthens the study area as an urban center.
Compatibility with Other Initiatives	• Project is compatible with other public transportation projects and studies underway including: Kenmore Improvements, Urban Ring, Green Line Operations Study, Fenway Interim Planning Overlay District Study, Yawkey-South Station Commuter Rail Shuttle.
Capital Costs	• $14.3 million for high-level platform, a crossover, additional coaches and increased parking in western suburbs in 1999 dollars.

Summary and Recommendations

Year 2001 forecasts indicate that implementation of full-time commuter rail service to the Fenway/Kenmore area would likely generate a small net increase in overall MBTA ridership (339 new riders each weekday). The service would yield operating daily revenues that slightly exceed estimated operating expenses. The capital investment required to expand the service would be approximately $14.3 million including the construction of a high level station platform, crossovers, the purchase of additional coaches to carry the increased ridership and expanded parking in the western suburbs. The new service would strengthen the Fenway/Kenmore area as an urban center.

More detailed analysis on physical constraints/construction costs and a firm commitment on shuttle services from the Longwood Medical Area are recommended before the MBTA fully commits to developing this potentially attractive service expansion opportunity. In addition to securing the necessary capital funds for the project, the MBTA should also consider the following:

- The new station stop will add two to three minutes to 20,000 daily rail passenger journeys between Boston and the western suburbs.
- The new service will marginally decrease the reliability of MBTA commuter rail service to and from South Station, and marginally detract from commuter rail's primary mission of delivering long haul passengers to the city's principal rail terminals.
- The expanded commuter rail service may impact freight operations.

CHAPTER 1
PROJECT SCOPE AND TRANSPORTATION OBJECTIVES

This report documents the methods and findings of a commuter rail station service expansion study. The study considers options for expansion of service to the vicinity of Yawkey Station on the MBTA's Worcester/Framingham line. This chapter describes the scope of the study and outlines the transportation objectives that would be served by the service expansion.

Project Scope

This feasibility study is being conducted for the MBTA's Planning Department. It builds upon technical work from a 1997-98 station feasibility study conducted for the nearby Allston/ Brighton area on the same commuter rail route.

The scope of the feasibility study provides for four principal project activities.

1. **Determine Service Objectives** - Determine transportation service objectives and markets to be served by expanded service to the area of Yawkey Station on the Worcester/Framingham line.

2. **Assemble and Update Technical Data** - Assemble and update technical data on physical, service and demographic characteristics of corridor and study area.

3. **Design and Evaluate Alternatives** - Design Fenway/Kenmore oriented modifications to Worcester/Framingham services that would respond to service objectives and markets. Determine the facilities required by proposed service modifications. Evaluate impacts on existing riders, new riders, capital costs, operating costs, Green Line ridership, and fare revenue.

4. **Joint Development** - Work with the MBTA and other groups to determine, document and evaluate joint development opportunities that may be created.

This report focuses on the first three activities. Some information on joint development has been developed and is presented where appropriate.

Background

The area around the existing Yawkey Station is comprised of three distinct sub-areas. The station area is approximately 2 miles from the downtown Financial and Shopping Districts. *Kenmore Square* is the area west of Back Bay, East of Boston University and North of the Massachusetts Turnpike. South of the Turnpike, the *Fenway* area is largely residential east of the Muddy River and more mixed to the west. A dominating feature of the west Fenway area is Fenway Park, the home of Major League Baseball's Boston Red Sox. Immediately south of the Fenway is a substantial concentration of medical and educational institutions known as the *Longwood Medical Area*.

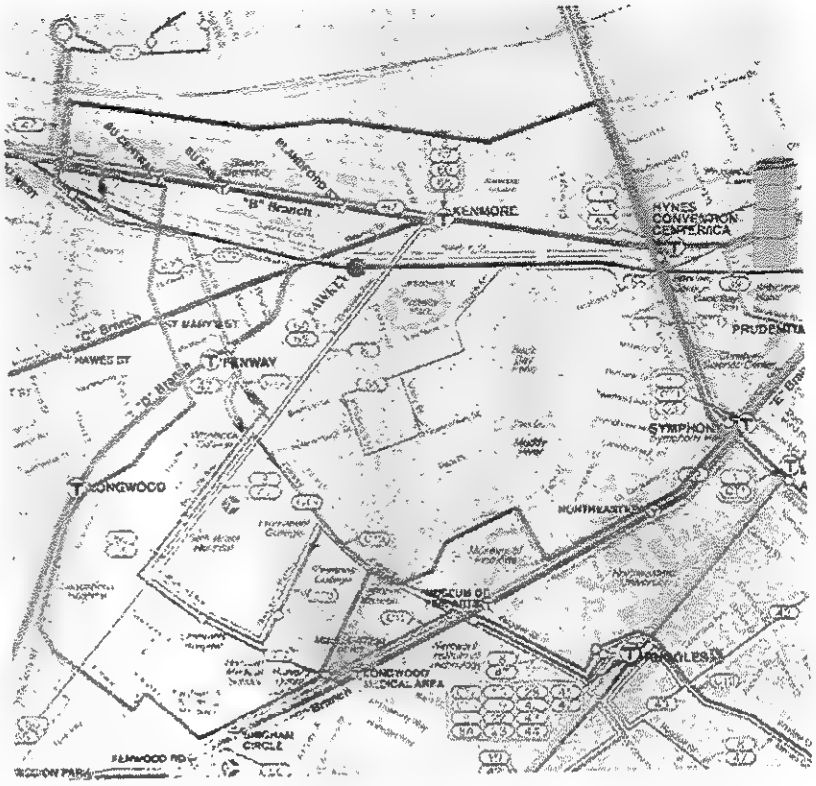


Figure 1.1: Aerial View of Study Area

These three districts of the city occupy an area of somewhat less than one square mile. Together, these districts are home to approximately 43,000 employees and almost 30,000 residents. The area is very densely served by local transit services including the MBTA Green Line and various bus routes. The area is not served by any direct transit service from points outside Route 128 with the notable exception of game day service on the MBTA's Worcester/ Framingham and Attleboro commuter rail lines to Yawkey Station near the Red Sox's Fenway Park.

Figure 1.2: Yawkey Station

Yawkey Station was developed in the late 1980's to serve Red Sox home games. For weekend day games, trains serve Yawkey Station from Framingham and South Attleboro (via South Station). For weeknight games, it is only served from Framingham. There is no service for weekend night games or early starts on weekdays. A Red Sox survey of stadium fans indicates that 3% of fans use commuter rail to get to the game. Counts made during the 1999 season indicate that Yawkey Station usage is actually closer to 1% of fans in attendance at the game sampled.

During the 1999 season, the Red Sox announced plans to develop a new stadium adjacent to their historic, but obsolete ballpark that was built in 1912. The proposed new stadium would seat approximately 10,000 more fans than the current park. This represents a nearly 30% increase over the capacity of the present ballpark. Traffic to and from ballgames already triggers substantial roadway congestion and parking competition to the area on the approximately 82 dates each season when the Red Sox play at home. The community is concerned about the traffic impacts of building a larger stadium in the neighborhood.

To help mitigate the impacts of the larger stadium, the baseball team has been exploring strategies to reduce the traffic impacts of game days. To help reduce problems on game days, the Red Sox and others are interested in improving transit accessibility to the study area. One transit improvement that could potentially improve general accessibility and reduce roadway traffic everyday in the study area would involve an upgrade of Yawkey Station from a game day station to a regular feature of the MBTA's everyday service. This study is designed to evaluate this potential daily commuter rail service to the Kenmore Square, Fenway and Longwood neighborhoods at an expanded Fenway/Kenmore commuter rail station.

Broad Service Options

A review of conceptual service options indicates that commuter rail service to the study area could be expanded in three ways:

1. **Add Fenway/Kenmore service to MBTA Worcester/Framingham Service** - Add a new study area station as a new stop for all commuter rail trains running between Worcester/Framingham and Boston.

2. **Develop a Fenway/Kenmore-South Station Shuttle** - Operate a commuter rail shuttle service that links the study area with Back Bay Station and South Station as a normal MBTA service.

3. **Expanded Game Day Service** - Expand game day service using more than the Worcester/Framingham and South Attleboro lines.

The scope of this report is limited to an evaluation of Option 1: full-time direct commuter rail service on the Worcester/Framingham line to the study area.

Transportation Objectives

To determine the transport objectives that an expanded commuter service would be expected to address, the study team met with numerous stakeholders representing interests in the study area. Several group meetings were held to brief the interested parties on the project, and to determine what their objectives would be for expanded service to the station. A list of meetings and interests represented at these meetings is found below.

Table 1.1

Schedule of Principal Project Outreach Meetings

Meeting	Represented Interests
MBTA September 29, 1999 October 8, 1999	Operations Department – Deputy General Manager Railroad Operations – Engineering & Transportation Officers Planning Department – Project Manager
City of Boston November 4, 1999	Boston Redevelopment Authority Boston Transportation and Parking Department City of Boston's Turnpike Air Rights Consultants - Goody Clancy
Longwood Medical Area October 7, 1999	MASCO (parking and transit services provider for Longwood Institutions)
Boston Red Sox October 5, 1999	Boston Red Sox Transportation Consultants – Howard/Stein Hudson and Vanasse and Associates Urban Design Consultants – Chan Krieger and Associates
Mass Turnpike November 17, 1999	Real Estate Development and Environmental Policy
CSX Corporation December 6, 1999	Operations Planning Governmental Affairs
Boston University November 29, 1999	Government and Community Affairs

At each meeting, the study team sought to determine each stakeholder's transportation objectives and constraints relative to expanded rail transit service to the study area. The findings relative to each party's objectives and constraints are discussed below.

Massachusetts Bay Transportation Authority

The study team met with MBTA officials responsible for planning and operations. The MBTA's specific objective for the design of any expanded services to the study area is to provide substantial improvements in overall transit mobility at a reasonable cost. That is, the MBTA is not interested in developing a new service or station targeting a small beneficiary population. Substantial benefits to a broad populace of travelers will be required to induce the MBTA to allocate resources to an expanded commuter rail service.

With respect to expanded service from Worcester and Framingham, MBTA operating managers are concerned about potential impacts on existing ridership to Back Bay and South Station. They are also concerned about maintaining smooth operations. They also cautioned the study team that CSX Corporation has significant control over developments on this line and noted that any station improvements would be subject to CSX approval. Finally, they pointed out that CSX could force the Authority to construct a non-standard station at, or near, the current Yawkey Station to accommodate expanded service. MBTA engineers indicated that they would be willing to review, and potentially accept, minor deviations from the Authority's published design standards if the economic and service justification for the expanded station is compelling.

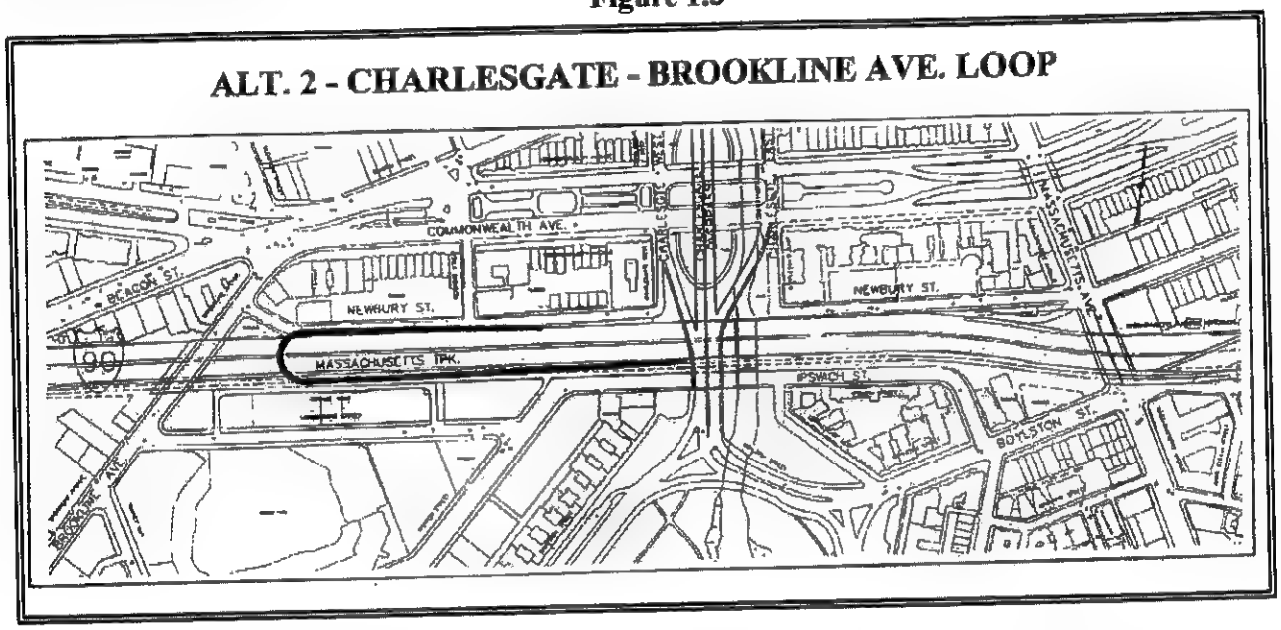
Regarding a shuttle service, MBTA operating managers could not be more emphatic in noting that capacity at South Station is not available at this time for new high frequency services. The number of berthing locations for commuter rail trains at South Station would need to be increased for the MBTA to seriously contemplate a shuttle service from Yawkey and Back Bay.

They also noted that adjustments in signaling and crossovers would likely be necessary to provide required capacity for a shuttle between Back Bay Station and the proposed new station.

The City of Boston

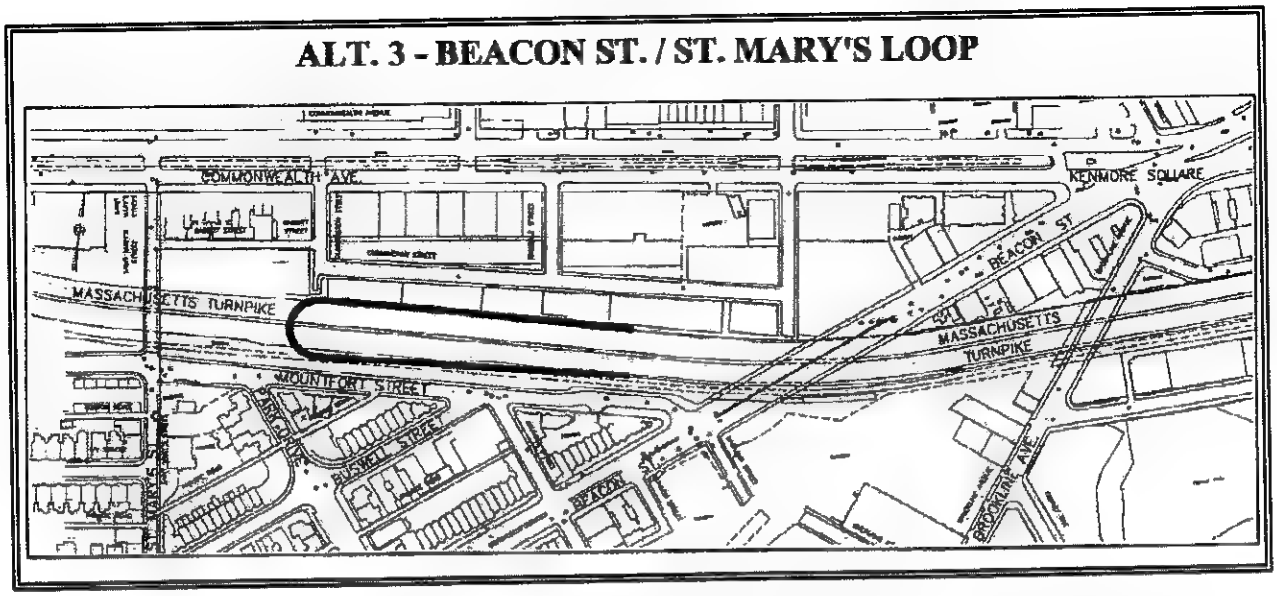
The City of Boston represents the interests of the residents of Boston as well as Boston businesses. In this particular policy sphere, the City is not only interested in the appropriate development of the Kenmore, Fenway and Longwood areas, but is also interested in air rights development over the Massachusetts Turnpike. With respect to South Boston, a commuter rail shuttle could potentially improve access between Back Bay and South Boston by providing a direct transfer to the new trolley/bus transit-way that will run between South Station and the World Trade Center.

Figure 1.3



The City is contemplating a highway strategy to improve access between Back Bay and South Boston. The highway strategy would involve a "slingshot ramp" providing a turn back for westbound traffic on the turnpike. Such a connection could potentially eliminate the need for westbound ramps on the turnpike extension near Back Bay. Slingshot options have been offered for two sites in the study area: one immediately west of the current Yawkey Station and one immediately east of Yawkey Station. These two options are illustrated in Figures 1.3 and 1.4. Highway ramp construction at either site would completely change the options and constraints that would face the MBTA in attempting to expand Yawkey Station. The City did not seem optimistic concerning the prospects of a slingshot ramp and suggested that project team discount the prospects of a slingshot ramp in the study area.

Figure 1.4



Focusing on the proposed new station, the City indicated that any new station should be located proximate to Brookline Avenue which is the main spine linking Kenmore Square, Fenway Park and the Longwood Medical Area.

The City is very interested in planning for the development of air rights over the Turnpike. The City noted that Boston University might be interested in developing over the highway west of Beacon Street. All things held constant, the City would prefer that the Red Sox construct their parking on air rights over the Turnpike and hold the surface sites adjacent to Yawkey Station available for other uses. However, the City does recognize that developing a parking complex over the highway would be more expensive.

The City is interested in a rail shuttle from the study area to South Station via Back Bay to provide service to the Convention Center. The City acknowledges that numerous operating and service considerations may make the development of such a service infeasible. The City appears less interested in full-time service to the study area from Worcester and Framingham.

In summary, Boston is interested in managing growth pressures in the study area, while improving urban form and livability, by exploring a commuter rail station on the Worcester/ Framingham line near Kenmore Square and Brookline Avenue. Boston is also interested in air rights development over the turnpike in the study area that would bridge the chasm between Kenmore Square and the Fenway Park area created by the rail/highway corridor. The City sees a commuter rail station developed in conjunction with the air rights and related developments as a potentially constructive supporting service.

The City is interested in learning more about the potential for a shuttle service between South Station and the study area, but is uncertain if such a service would meet its convention center related transportation objectives. Finally, the City is interested in preserving the option to

develop a shuttle with a connection to the Green Line Fenway Station at some future date if it is proven viable

Longwood Medical Area

The Longwood Medical Community is the one of the largest and most dense employment concentrations in Boston. With numerous hospitals, clinics, research laboratories and schools, the community is under constant pressure to improve transportation access to the area. MASCO coordinates transportation initiatives for the Longwood institutions.

MASCO was established in 1972 by its member institutions. Its mission is to plan, develop, and enhance the Longwood Medical and Academic Area for the benefit of its members and the public. MASCO is charged to create and implement programs that assist the institutions and individuals in the Longwood Medical Area (LMA). MASCO and its affiliates offer a wide range of services including area planning and development, parking and transit services, shared business services, and child care.

In the area of transportation, MASCO develops and implements parking and transportation strategies to improve area accessibility for employees, students, patients, and visitors. MASCO manages and operates parking facilities and provides shuttle bus services to and from parking facilities outside the LMA. The shuttles serve employees of member institutions in an effort to reduce automobile traffic within the LMA. Four shuttle bus services link LMA with remote MASCO parking lots including a lot adjacent to Yawkey Station. A fifth shuttle route provides a direct free transit link for LMA employees between the MBTA's Ruggles Station on the Orange Line and the LMA. MASCO also provides a shuttle bus service between the Harvard Medical School in the LMA and Harvard University in Cambridge.

MASCO is very interested in exploring full-time commuter rail service to the study area. A MASCO shuttle bus from the adjacent parking lot already serves the station. Commuters using the proposed new station would reduce vehicular traffic and alleviate parking shortages in the medical area. MASCO indicated a commitment to meet every peak train at the new proposed station with a shuttle trip. Off-peak trips could be served with the existing parking shuttle.

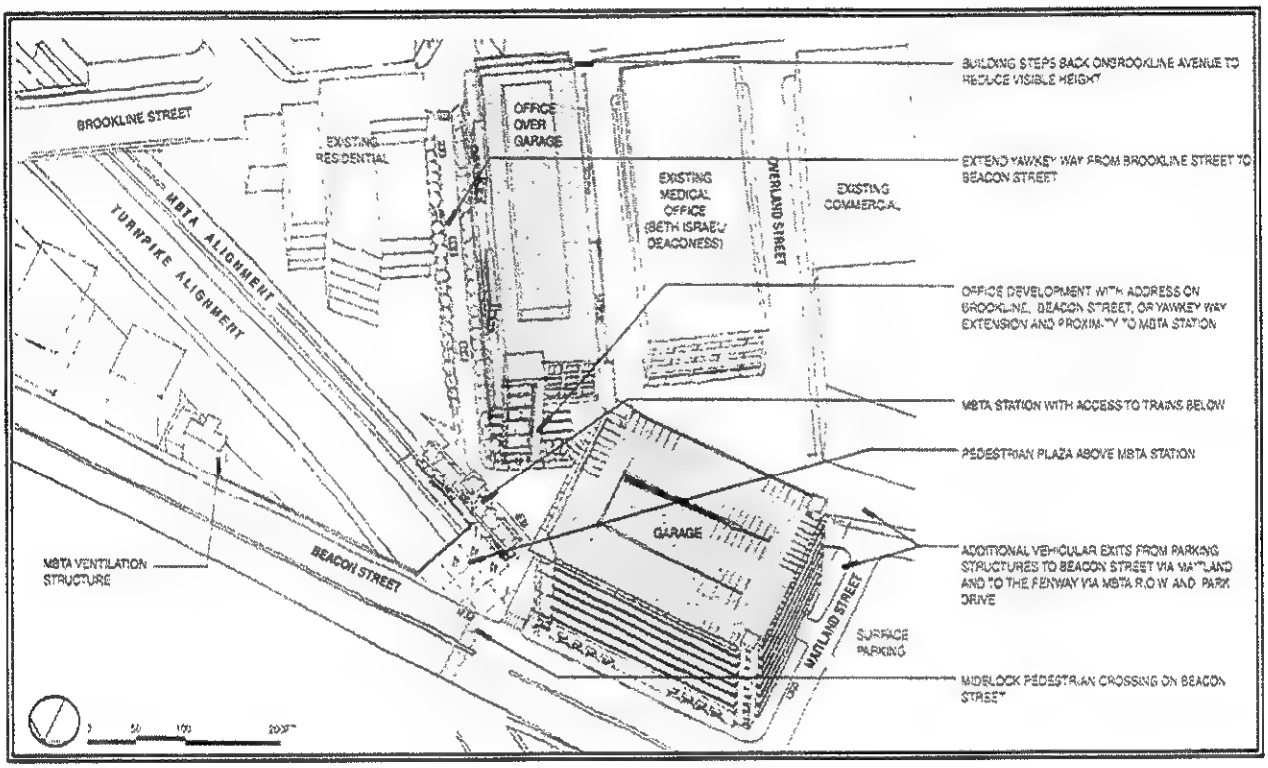
MASCO does <u>not</u> support a rail shuttle service between the study area, Back Bay and South Stations. In MASCO's appraisal of the travel market, such a shuttle would not compete well with the Green Line. In MASCO's view, if the commuter rail shuttle became a success, it would siphon reverse peak traffic from the Green Line. The reverse peak commuters diverted from the Green Line would require MASCO to provide a new shuttle bus service.

Boston Red Sox

The Boston Red Sox are interested in exploring transit investments that would improve overall neighborhood accessibility, improve access to the ballpark, and reduce the traffic impacts of the enlarged stadium. The baseball team appears interested in investments that would be favorably received by its neighbors. It hopes transit investments will mitigate potential increases in traffic that would result from the new ballpark. With those objectives in mind, the team and its consultants are very interested in full-time commuter rail service to the study area from Worcester and Framingham. They are also interested in a shuttle train that would regularly operate between South Station and the study area through Back Bay Station.

From an urban design perspective, the Red Sox and their advisors note the new proposed station would work best on, or near, Brookline Avenue. Brookline Avenue is the main thoroughfare connecting Kenmore Square with the Fenway Park and the Longwood Medical Area. They also emphasize that shuttle services should be designed to minimize any noise or inconvenience to residents in nearby homes. In particular, a cross-platform transfer at the Green Line's Fenway Park station between the Green Line and a commuter rail shuttle station would be attractive to travelers, but could trigger complaints from neighbors. The Red Sox are very sensitive to potential complaints from neighbors of the proposed new ballpark.

Figure 1.5

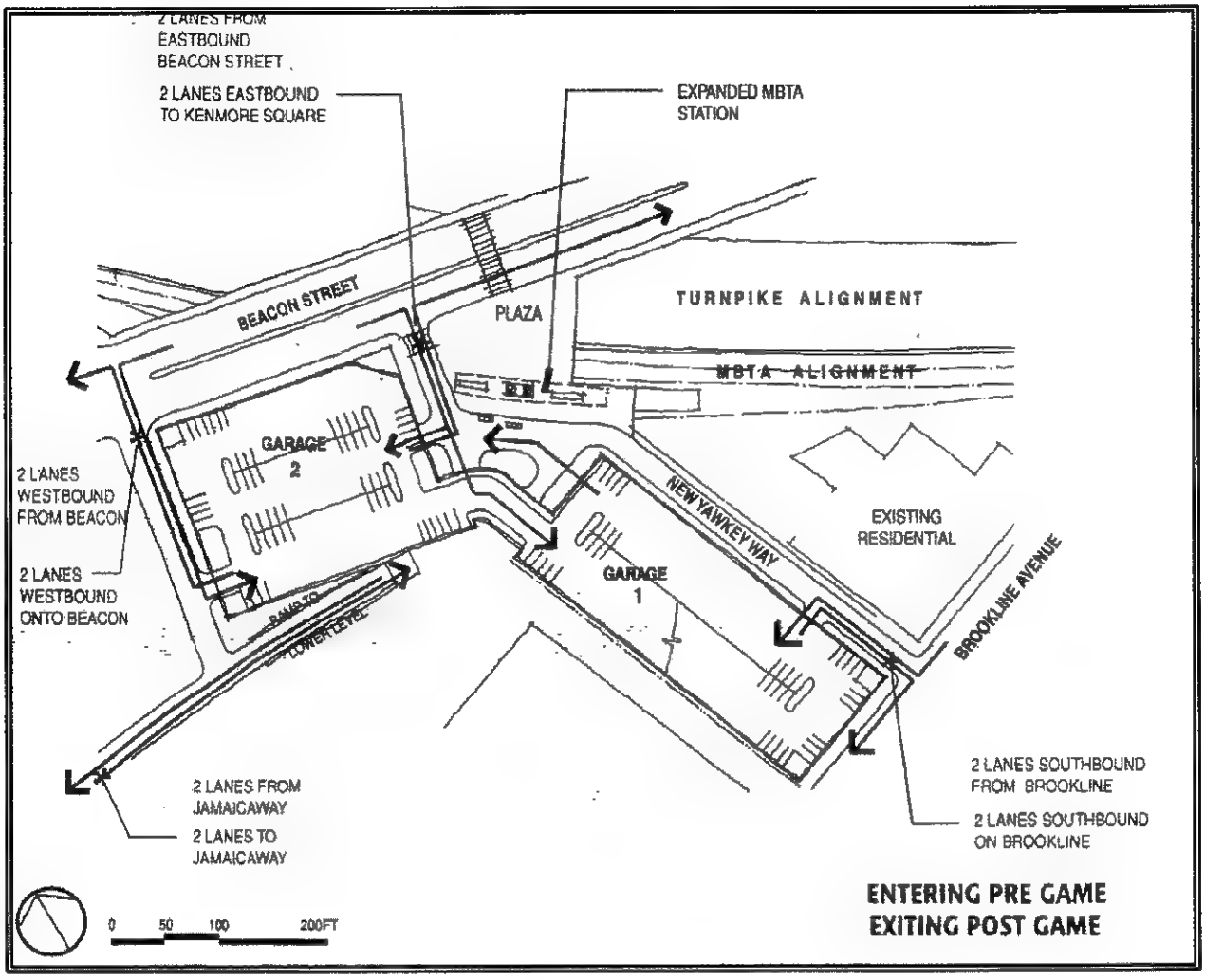


The Red Sox are planning to build one or more parking structures adjacent to the current Yawkey Station. They propose to incorporate the construction of the expanded station into the parking decks with a headhouse and plaza at the level of Brookline Avenue and Beacon Street as in Figure 1.5. The plaza and headhouse would be designed to facilitate the circulation of shuttle buses between the new proposed station and nearby workplaces such as the Longwood Medical Area. Any plans for a shuttle station off the main line would need to be carefully coordinated with Red Sox parking development plans, since any off line station would conflict with their current plans for parking garages.

With respect to development on air rights over the adjacent Massachusetts Turnpike, the Red Sox are not contemplating the expense or risk of such development. However, they would support an air rights development strategy to help bridge the chasm between the Fenway area and Kenmore Square, if funding and leadership were to arise from others. The Red Sox have

developed conceptual plans of how parking could be developed in air rights over the rail/turnpike corridor but would not be likely to independently undertake and finance such a costly project.

Figure 1.6



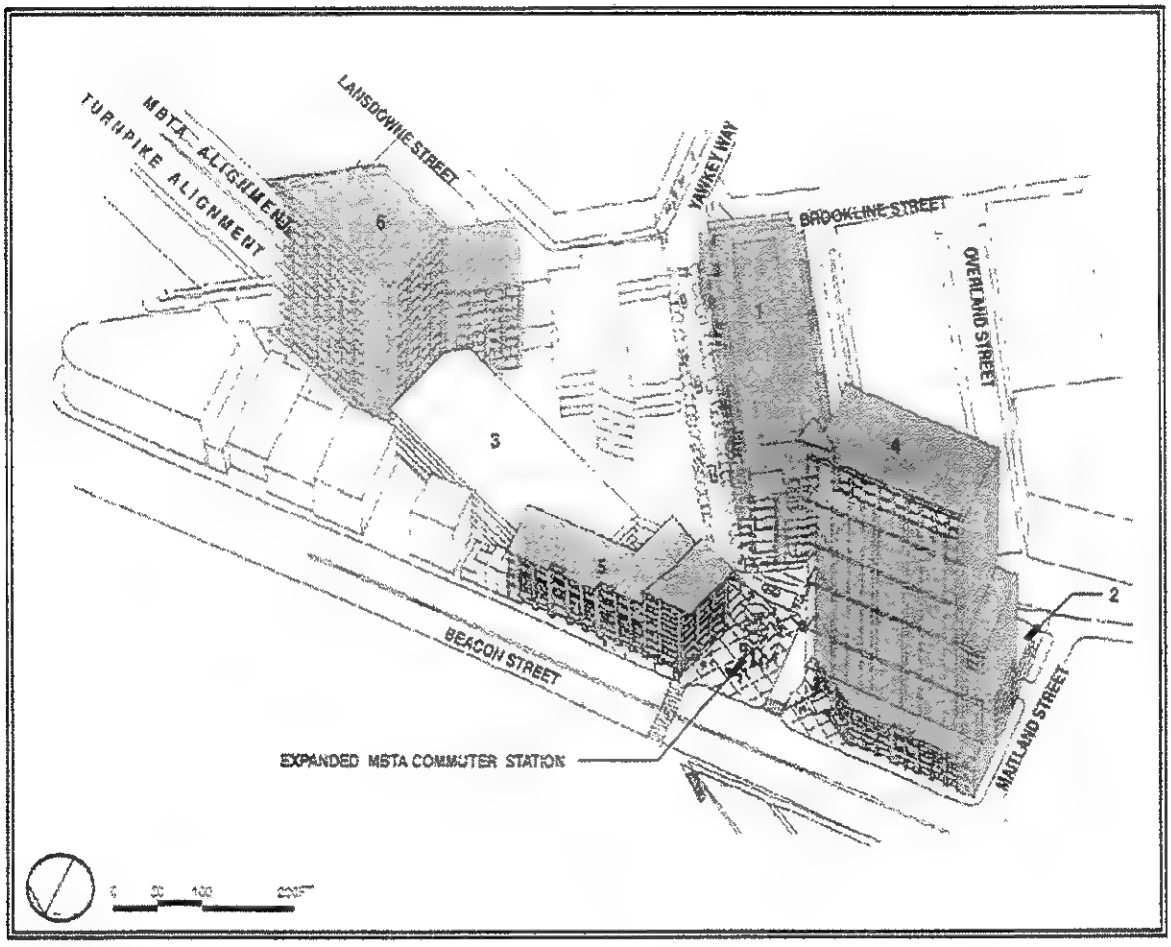
Massachusetts Turnpike Authority

The study team met with the Turnpike's Chief of Real Estate Development and Environmental Policy to discuss the proposed new service and station expansion. The Turnpike owns most of the property where the Red Sox have proposed constructing the parking facilities illustrated in Figures 1.5 and 1.6. The Turnpike also owns the rail right of way. Presently the Turnpike is very interested in promoting development on Turnpike owned parcels such as the land proposed for the Red Sox parking garage and is marketing the right to develop the air rights over the turnpike in Boston.

As Red Sox development plans evolve, it is likely that the Turnpike will encourage the Red Sox to develop some or all the required parking over the turnpike and leave the developable land available for more substantial land uses. With some parking located over the transportation right _

of way, the Turnpike hopes that more of their Yawkey parcel could be developed into a combination of commercial, retail and residential development that would generate substantially more real estate value than a parking garage. The conceptual plan illustrated in Figure 1.7 provides the same 2,250 parking spaces provided in the plan illustrated in Figure 1.5. However, Garage 2 is moved over the turnpike and the site that had been proposed for Garage 2 is developed as a 23-story office tower. The plan would also construct two other non-parking structures: a four story retail and office or residential structure on air rights at Beacon Street, and a 15 story research laboratory on air rights at Brookline Avenue.

Figure 1.7



As the projects to build a new Fenway Park and to develop the Turnpike's air rights parcels near Kenmore Square move forward, it would be reasonable to project a synergy would develop between the Red Sox need for fan parking and the Turnpike's desires. With proper planning and coordination, the Turnpike's air rights development will not interfere with MBTA commuter rail operations. Most air rights developers at the new proposed station site would be interested in expanding the station and promoting full-time weekday service to the site.

Immediately west of Beacon Street, the Turnpike reports that Boston University is very interested in developing a Science building on air rights over the highway and rail corridor. This building would be constructed to face Beacon Street on the east.

Boston University

KKO conducted a brief telephone call with Boston University (BU) to determine the depth of the University's interest in developing in air rights over the highway/rail corridor. The call also sought to identify any potential conflicts with full-time commuter rail service to the study area.

Although it has not been widely publicized, BU is hoping to soon build a new science building over the turnpike corridor immediately west of Beacon Street. This extension of the campus would provide pedestrian linkages across the turnpike and would front onto the western side of the Beacon Street overpass as if it were a surface street. Over the longer term, BU is also interested in developing on air rights west of the proposed science building.

Boston University is supportive of full-time service to the study area and envisions that it will add new accessibility to the University and to Kenmore Square. BU is concerned that the MBTA and BU coordinate to ensure the plans for the new proposed station and plans for the new science building do not conflict.

If the current Yawkey Station is expanded and BU builds a science building on air rights west of Beacon Street, the station design should be adjusted. It would be wise to shift the MBTA station platforms west so locomotives on the west end of the train would not dwell under the new building. (Locomotives on the push-pull commuter rail trains serving Framingham and Worcester are always positioned on the west end of the train.) With platforms extending all the way under the proposed science complex, locomotives would not tarry under the air rights development as they do at Back Bay Station. Thus, most of the engine exhaust and fumes would be vented to the open air rather than being confined in the station chamber under the bridge and building.

CSX Corporation

The study team held a conference call with CSX Corporation passenger service and operations managers. CSX is the freight operator on the rail line and is responsible for rail infrastructure maintenance west of Back Bay. The call discussed the proposed expansion of service and sought to determine what constraints CSX would impose on the development and operation of the proposed new service. As the freight operator on the line, CSX is primarily concerned about potential impacts on freight train movements. Service to the proposed new station could affect freight service in two ways:

> First, the construction of a high level platform adjacent to the tracks would reduce the flexibility of the line for the movement of wide loads.
>
> Second, changes or increases in the schedule of passenger trains could impact CSX's ability to schedule and operate freight trains.

CSX was told that the proposed new station would be served on Track Two, the southern track, by one platform on that track. To minimize dwell times and provide a high level of accessibility,

the MBTA would prefer to build a high level platform on that track. The project could recommend that the platform length be less than the MBTA standard of 800 feet for a high level platform, but there would not be a need to realign track or move bridge abutments.

CSX was also told that within the project analysis, a crossover between Yawkey and Back Bay Stations had been considered at approximately Milepost 2. This crossover would add to the flexibility of the main line in terms of both passenger and freight movement.

High-Level Platforms - CSX noted that as a rule, CSX does not allow high-level platforms on its lines. However, when a high-level platform on only one track of two-track segment with a low freight density was discussed, CSX showed a potential inclination toward flexibility. CSX suggested that a high-level platform on one track with crossover facilities to run around the station could be found potentially acceptable by CSX.

CSX did not indicate any objection to a long low-level platform on Track Two near the current Yawkey Station. CSX indicated that high-level platforms on both tracks at the new proposed station would be completely unacceptable to CSX.

Conflicts between Freight and Passenger Trains - In thinking about the new proposed station, CSX was primarily interested in any impacts that would ripple westward. Most CSX-Boston traffic terminates at Beacon Park Yard. Consequently, CSX is mostly concerned about impacts on freight traffic west of Beacon Park Yard. CSX is concerned that stopping trains at the new proposed station could result in service queues west of Beacon Park Yard. The study team noted that any operational plan that resulted in a queue of standing trains would also be unacceptable to the MBTA. With the proposed new service, station-to-station train velocity west of the new station is not affected. Train arrival or departure times would generally be shifted two or three minutes to allow time for service to the new station.

Summary

A table listing the ten transportation-related project objectives distilled from the meetings with interested parties is found in Table 1.2

Table 1.2
Summary of Transportation Objectives

1.	Improve overall non-highway accessibility to study area.
2.	Reduce overall traffic and demand for parking in the study area.
3.	Reduce impacts of enlarged stadium.
4.	Strengthen Kenmore/Fenway area as an urban activity center.
5.	Avoid project impacts on study area residents.
6.	Support air rights development over the turnpike.
7.	Reduce traffic congestion and parking demand at Longwood Medical area.
8.	Manage growth pressures in the study area, while improving urban form & livability.
9.	Maintain rail freight access to South Boston.
10.	Improve rail freight operations in Boston.

Table 2.1 shows each station and its associated commuting characteristics:

Table 2.1

Worcester/ Framingham Service and Demand Characteristics by Station[1]					
Station	**Miles to South Station**	**Number of Daily Trains**	**Avg Peak Speed to South Station**	**Avg Peak Mins to South Station**	**Daily Inbound Boardings**
Worcester	44.2	20	34	69	917
Millbury	39.4	20	34	N/A	*148*
North Grafton	36.5	20	34	N/A	*116*
Westborough	33.9	20	34	N/A	*216*
Southborough	27.5	20	33	N/A	*550*
Ashland	24.9	20	33	N/A	*738*
Framingham	21.4	37	29	44	1,634
West Natick	19.8	35	30	39	1,338
Natick	17.7	34	27	40	883
Wellesley Square	14.7	31	26	34	696
Wellesley Hills	13.5	31	27	31	567
Wellesley Farms	12.5	31	26	27	518
MassPike/128	11.5	*N/A*	*N/A*	*N/A*	*600*
Auburndale	10.2	22	26	23	374
West Newton	9.1	22	27	20	374
Newtonville	8.1	22	29	16	512
Yawkey Station	2.3	NA	NA	NA	NA
				Total	**7,813**

Projected boardings in italics.

[1] Numbers of trains, speeds and travel times for stations west of Framingham (excluding Worcester) represents planned future service. Current service conditions are different. Station names in italics represent future planned stations and daily boarding figures in italics are MBTA projections for future service at planned stations. Other boarding figures are from Winter 1999 counts of actual riders.

MBTA Yawkey Station Service - MBTA service on the line includes special service to Yawkey Station at Milepost 2.3. The station was opened in the late 1980's to serve baseball games. At this time, the station is only used when the Red Sox are playing at Fenway Park. No special trains are operated for the baseball fans. Instead, existing trains are stopped at Yawkey Station for the convenience of the fans. On weekends, services are offered on the Attleboro and Framingham lines. On weekdays, only fans from the Framingham corridor are served. Service is operated for 1pm afternoon games on weekends and 7pm games on weeknights. No service is offered for weekend late afternoon or evening games. Early games on weekdays are not served.

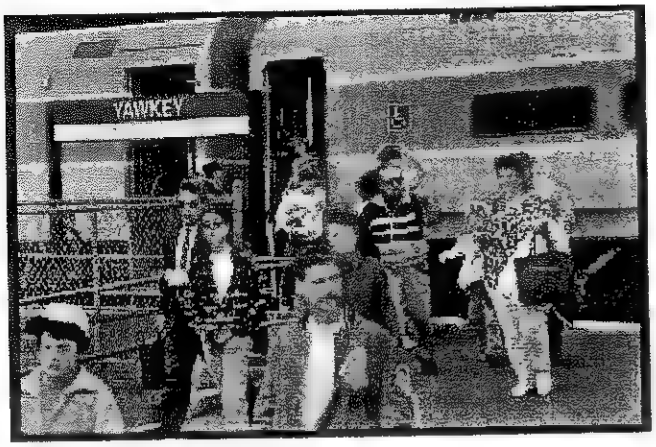


Figure 2.1: Yawkey Station on game day

For weekend day games starting at 1:05 pm, the MBTA has scheduled service to Yawkey Station from Framingham and South Attleboro. The noon train from Framingham serves fans from the western suburbs. Southern suburban fans are served by the 11:35 am train from South Attleboro that interlines with the 12:35 pm departure to Framingham and Yawkey Station. Fans from the west arrive at 12:35 pm. Fans from the south arrive at ten minutes later at 12:45 pm. Return service to the west is provided by the 4:30 pm train from South Station to Framingham that calls on Yawkey Station at 4:40 pm. Return service to the southern suburbs is provided via the 3:45 pm train from Framingham calling on Yawkey Station at 4:20 pm. This Framingham train is interlined with the 4:45 pm departure from South Station to South Attleboro.

For weekday night games starting at 7:05 pm, the MBTA has scheduled service to Yawkey Station from Framingham but not South Attleboro. Weekday evening fans can board the 5:40 pm or 6:30 pm trains from Framingham which both call on Yawkey Station. Return service westward on the Framingham line is offered at 10:15 pm and 11:15 pm on regularly scheduled trips to Framingham.

According to Red Sox fan surveys, approximately 3% of fans arrive by commuter rail. Reported trends in commuter rail use among Red Sox fans are positive.

Table 2.2

Proportion of Red Sox Fans Reported Travelling by MBTA Commuter Rail

1994	1995	1996
2.8%	3.1%	3.6%

Source: "Boston Red Sox In-Stadium Comparison 1994-96 by Marketing Information Technologies, Little Rock, Ark.

A 1999 field survey by the Central Transportation Planning Staff (CTPS) suggests that the commuter rail mode share reported by stadium fans may be higher than actual experience. On the evening of Tuesday, July 20, 1999, the Florida Marlins played the Red Sox at Fenway Park. The Red Sox report that approximately 25,000 fans attended the game. CTPS field surveyors were stationed at Yawkey Station that evening to count passengers boarding and alighting at Yawkey Station. They counted 164 passengers using Yawkey Station to arrive before the game and 199 using Yawkey Station to leave after the game. On this night, the commuter rail share of total fans travelling to fan was no more than 0.7%.

Ownership and Control of the Line

The rail line between Boston's South Station and Worcester is owned by three different entities:

- Massachusetts Bay Transportation Authority,
- Massachusetts Turnpike Authority, and
- CSX Corporation.

Trackage rights (easements) are granted to Amtrak, MBTA and CSX to operate on the line segments owned by the others. Between Worcester and "Cove" interlocking, immediately east of Back Bay, the CSX Boston dispatcher stationed in Selkirk, New York dispatches the line. Between Cove interlocking and South Station, the Amtrak dispatcher in South Station dispatches the line. Dispatch control of the line is an important consideration. Assigning priority to trains and accountability for dispatching problems rests with the dispatching carrier.

CSX forces maintain the line at all points west of Back Bay Station. CSX should be consulted and satisfied regarding any changes to the line's infrastructure that would impact operations. Since changes to provide full service to Yawkey Station may affect signals and clearance envelopes, CSX should be consulted.

Table 2.3

Ownership by Line Segment

Owner	Starting Milepost	Ending Milepost	Description (east to west)
MBTA	0	1	South Station to Back Bay
Mass Pike	1	11	Back Bay to Riverside
MBTA	11	23	Riverside to Framingham
CSX	24	45	Framingham to Worcester

The Worcester/Framingham line is primarily a double-tracked railroad. Between Worcester and Boston, the 44.2 mile long line has ten interlocking plants where trains can move from one track to another.[2] Interlockings allow trains to cross from track to track so that express trains can pass local and stopped trains. Both track configuration and the locations of interlockings and track

[2] Interlockings are combinations of signals and switches that allow the dispatcher to stop trains and route them to change main tracks. This allows the railroad the flexibility run service past standing trains, take tracks out of service for maintenance, etc. Interlockings are often referred to by the letters "CP" and the number of a nearby mile post (such as "CP11").

signals are important because they can either constrain schedule options or, conversely, provide increased operational flexibility. For purposes of this study, the most significant interlockings are

- Cove (immediately east of Back Bay Station),
- CP3 (near the Boston/Brookline line where the railroad passes under Commonwealth Avenue), and
- CP4 (in Brighton between Market and Everett streets).

Each of these interlockings is a double-track "universal" interlocking. Each allows eastward and westward trains to move between tracks without stopping or reversing direction.

As noted above, the Worcester/Framingham line is primarily a double-tracked railroad. There are, however, significant exceptions:

- In Newton, the location of the station platforms between the turnpike and the railroad effectively makes Track Two the only track from which trains can make station stops.[3]

- Passenger service is restricted to Track Two for 1.8 miles between CP4 (in Brighton) and CP3 (at the intersection of Commonwealth Avenue and Essex Street) in the vicinity of CSX's Beacon Park Yard in Allston.

The line is equipped with a Rule 261 (CTC) signal system that allows trains to be safely run at track speed in either direction on both tracks. West of CP23 in Framingham, the line is also equipped with cab signals. With cab signals, the maximum speed allowed by the signal system at any point and time is transmitted directly into the engineer's cab for continuous monitoring; the train automatically stops if speed limits are ignored; and reliance on the train crew to note, recall, and obey wayside signals is eliminated.

The railroad generally has a 60 mph maximum speed. There are, however several areas with speed restrictions below 60 mph.

- between milepost zero and milepost five due to the stations, curves, and interlockings between South Station and the west end of the Beacon Park Yard in Brighton.

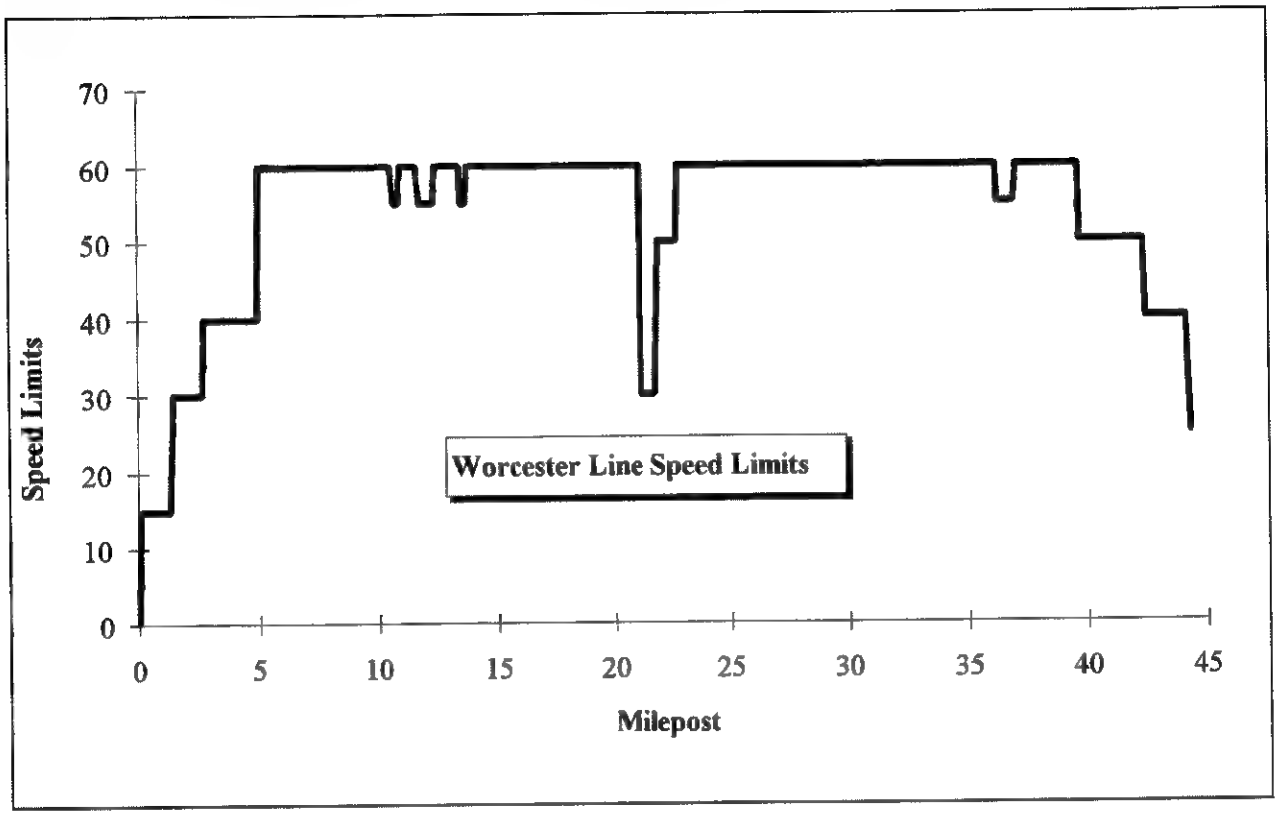
- between mileposts 10 and 15 due to curves in Wellesley.

- between mileposts 20 and 25 due to numerous switches and sidings in the vicinity of the Framingham station.

[3] Track Two is the more southerly of the two tracks. Normally, this track would be the eastbound track. However, westbound trains stopping at the Newton stations must run "left-handed" (against the normal direction of traffic) on Track Two for 6.6 miles between CP4 in Brighton and CP11 west of Riverside. This, in turn, forces some eastbound trains which are not stopping in Newton to run "left-handed" on the normally westbound Track One from CP11 to CP4.

Many speed restrictions beyond milepost 39 were removed in 1997 when the MBTA upgraded the track as part of the Worcester project. The speed west of milepost 39 is now generally 60 mph. The following diagram shows the speed restrictions between Boston (MP0) and Worcester (MP44.2):

Figure 2.2
Maximum Allowable Speed by Milepost: Boston to Worcester
(1996)



Source: Conrail System Timetable
Milepost 5 is near Allston; milepost 21 is near Framingham

Existing Rail Passenger Operations
Both the MBTA and Amtrak operate passenger services on the line.

MBTA - The current schedule of MBTA service is shown in Appendix A. It features five daily round trips to Worcester and 27 revenue trains originating or terminating in Framingham. There are also two daily MBTA non-revenue (dead head) trains between Boston and Framingham because there is no place to store trains overnight in Framingham.

Passenger fares for MBTA service vary with the distance from Boston. Table 2.4 shows the one-way fares and monthly pass price.

Table 2.4

Worcester/Framingham Fares				
Station	**Fare Zone**	**One Way Fare**	**Monthly Pass Price**	**Daily Inbound Boardings**
Worcester	9	$4.75	$136.00	917
Framingham	5	$3.25	$104.00	1,634
West Natick	4	$3.00	$94.00	1,338
Natick	4	$3.00	$94.00	883
Wellesley Square	3	$2.50	$82.00	696
Wellesley Hills	3	$2.50	$82.00	567
Wellesley Farms	3	$2.50	$82.00	518
Auburndale	2	$2.25	$72.00	374
West Newton	2	$2.25	$72.00	374
Newtonville	1	$2.00	$64.00	512

Amtrak - Under normal circumstances, Amtrak operates four daily intercity trains on the line: a round trip to Chicago and a round-trip to Norfolk Virginia via Hartford, New York and Washington. During 1999, Amtrak operated more trains on this route to free up track time for work on the electrification of the Boston-Providence-New Haven route. These trains were re-routed back to the ShoreLine once the electrification project was complete.

Future Rail Passenger Operations

Over the next ten years, several significant changes in passenger operations for this line are planned including: doubling the number of daily round trips to Worcester, building new stations between Worcester and Framingham, and building a major new regional park-and-ride station near where the rail line passes under Route 128. Four stations in the communities between Worcester and Framingham are under construction and should be open before 2001:

Table 2.5

New Worcester Line Stations	
Station	**Projected Daily Inbound Boardings**
North Grafton	148
Westborough	116
Southborough	216
Ashland	550

A station in Millbury has also been proposed. The four new stations will come online as they are completed starting late in 1999. All four stations are scheduled to open by the end of 2000. At that time, the MBTA plans to double the number of trains serving Worcester and increase total passenger service on the line to 42 daily trains. Additional Worcester round trips - mostly extensions of existing Framingham trains - could be added if ridership demand is demonstrated. A representative future MBTA Worcester/ Framingham timetable is found in Appendix A.

A new regional station (tentatively called "Mass Pike") has been considered near the intersection of Route 128 and the turnpike - slightly west of the old Riverside station. It is anticipated that nearly all MBTA trains (and possibly Amtrak trains) will stop at this station. There are no plans to add additional trains originating at the planned Mass Pike/Route 128 station. Expanded parking facilities are also planned for Natick and Framingham.

As noted above, Amtrak projects that its use of the line will probably remain at the current level although the schedule times of the trains might change.

Existing Rail Freight Service

CSX provides all freight service on the line. At Selkirk, New York (near Albany), the line connects with major freight routes from Chicago, Montreal, Newark, and Pennsylvania. The line is New England's busiest freight line. CSX uses this line as the spine of a network of short line and regional railroads to all of New England. Much of the freight traffic into New England leaves the Boston & Albany main line before reaching Brighton, primarily at Springfield, Palmer, Worcester, Westborough, and Framingham.

Approximately fourteen daily freight trains operate between Framingham and Beacon Park Yard, two daily freight trains between Beacon Park Yard and South Boston, and two daily freight trains between Beacon Park Yard and Chelsea via the rail bridge over the Charles River. This rail bridge is part of the Grand Junction route that is used by the MBTA to move locomotives and empty passenger cars between the South Side and North Side commuter rail systems.

CSX's Beacon Park Yard is Boston's largest and most active rail freight yard. Most of the freight traffic is intermodal and moved by truck to its final destination. However, some cars are switched into the local trains to Chelsea and South Boston. Yard operations significantly impact the capacity of the rail line for passenger trains - primarily due to single-track passenger operations between CP3 and CP4 and due to speed restrictions at these two interlockings.

Future Rail Freight Service

CSX has indicated that the number of trains operating between Framingham and Beacon Park Yard will probably not decrease and may increase over the next few years. Three impending changes in the rail freight system could impact passenger rail operations on the Boston and Albany main line.

First, the recent growth in volumes of containerized intermodal traffic carried by the nation's railroads will probably continue as railroads and truck carriers form partnerships to provide faster and more reliable lower cost services to their customers. The advent of double stack[4]

[4] "Double stack" involves placing two intermodal containers on top of each other on special low flatcars. To enable double stack, clearances must be increased at some low bridges over the railroad.

containerized technologies into the Boston area will cut rail costs for handling containers by approximately 25% and increase rail's share of general merchandise traffic. In 1995, the Commonwealth, Conrail, and some regional carriers entered an agreement to improve rail freight service to Eastern Massachusetts by extending double stack clearances on the Boston to Albany main line as far east as Beacon Park Yard and the Port of Boston. CSX anticipates that the volume of rail freight traffic into and out of the Port of Boston and Beacon Park Yard will increase substantially when the clearance work is completed.

Second, dramatic shifts in the competitive balance among large freight railroads in the Northeast have recently occurred as the two southeastern giants, CSX Corporation and Norfolk Southern submitted a plan for federal approval to acquire Conrail, the major freight railroad serving the northeast. In June of 1999, CSX took over Conrail's New England operations. The merger of Conrail and CSX will improve access and the quality of freight service between New England and the Middle Atlantic, Southeastern and Southwestern states. This should result in a further increase in freight tonnage over the line, as the far-reaching merged company would be able to divert more freight business from the trucking industry. Significantly, the merger could also result in relocation of the dispatchers controlling train operations on the Boston & Albany (the B&A) line from Selkirk, New York to Jacksonville, Florida.

Third, CSX's predecessor had long-range plans to divest itself of its New England branch lines by selling them to short line and regional carriers. These plans have been sidelined by CSX, but should the plans be revived, they could result in the use of Beacon Park Yard as an interchange point between rail carriers.

With all these factors in play, Massachusetts and Boston should expect rail freight activity to rise substantially on the Boston & Albany main line and at Beacon Park Yard.

CHAPTER 3
LAND USE AND COMMUTING PATTERNS IN THE STUDY AREA

Figure 3.1

The study area for the Fenway/Kenmore commuter rail service study was established based on the team's understanding of the markets that would be served by a full-time service to station from Worcester/Framingham service. The MBTA was consulted on the definition of the study area limits.

The total study area is somewhat less than one square mile. There are slightly more than 28,000 inhabitants. For the purposes of analysis and discussion, the area was divided into three sub-areas based on 1990 US Census tract geography and traffic analysis zones established by the Central Transportation Planning Staff. (CTPS)

Table 3.1

1990 Study Area Characteristics

Sub Area	Approximate Boundaries	1990 Population	Area (Sq. Mi.)
Kenmore Square	North of Turnpike South of Charles River West of Massachusetts Avenue East of Boston University Bridge	9,155	0.22
Fenway	North of Park Drive South of Turnpike West of Massachusetts Avenue East of Saint Mary's Street	16,746	0.37
Longwood Medical Area	North of Fenwood Road South of Park Drive West of Huntington Avenue East of The Riverway	2,360	0.25
Total		**28,261**	**0.84**

Source: CTPS. Does not include water or park land.

The study area has approximately 11,400 households and almost 9,000 persons living in dormitories and other group quarters. Population is concentrated in the Fenway area as shown in Table 3.2.

Table 3.2

1990 Population Statistics

Sub Area	Total Population	Non-Household Population	Household Population	Number of Households	Avg. Household Size
Kenmore Square	9,155	5,718	3,437	2,131	1.6
Fenway	16,746	1,497	15,249	8,848	1.7
Longwood Medical Area	2,360	1,727	633	393	1.6
Total	**28,261**	**8,942**	**19,319**	**11,372**	**1.7**

There is more than 30 million square feet of building space in the study area. 47 percent of this space is residential; 25 percent is office space; 15 percent is school space; 9 percent is manufacturing and warehouse space; and 4 percent is retail space.

Table 3.3

1996 Built Environment
(000's of square feet)

Sub Area	Total Floor Space	Residential	White Collar	Schools	Retail	Blue Collar
Kenmore Square	6,934	3,724	1,194	1,608	345	63
Fenway	15,235	9,494	2,747	541	741	1,711
Longwood Medical Area	8,474	1,162	3,859	2,439	170	844
Total	**30,643**	**14,380**	**7,800**	**4,588**	**1,256**	**2,618**

Based on CTPS adjustments to 1996 Boston assessor's data

More than forty three thousand persons are employed in the study area. 69 percent of the people are employed in office occupations. Colleges employ an additional 18 percent of local workers. Approximately seven percent are employed in retail, and approximately five percent are employed in manufacturing, distribution and warehousing jobs. K-12 schools employ only one percent.

Table 3.4

1996 Employment

Sub Area	Total Employment	White Collar	School (K-12)	Colleges	Retail	Blue Collar
Kenmore Square	9,396	2,652	0	5,055	1,193	496
Fenway	7,030	3,216	53	653	1,651	1,459
Longwood Medical Area	26,792	23,817	346	2,019	252	356
Total	**43,218**	**29,685**	**399**	**7,727**	**3,096**	**2,311**

Based on CTPS 1996 adjustments

The 1996 CTPS assessment of study area employment is generally consistent with a more recent estimate of Longwood Medical Area employment prepared by MASCO. According to that estimate, approximately 30,000 persons work in the Longwood Medical Area; of these employees MASCO estimates that approximately 4,300 live in or near the corridor served by the Worcester/Framingham line. This number represents 14% of total Longwood area employment.

Table 3.5

Longwood Medical Area Employees
Estimated to Live in Corridor Served by Worcester/Framingham Line

Sub-corridor	Number of Employees	Percent of Total Employment
Route 9 Sub-corridor	989	3%
Mass Pike Sub corridor	599	2%
Newton	2,679	9%
Total	**4,268**	**14%**

The 1990 US Census provides data on how workers travel to their jobs. Among all persons employed in the study area and working outside their homes, the most frequently reported way of travelling to and from work in the study area is to drive alone, with 43% of the area's workers reporting that they drive alone to work. A total of 27% of workers reported that they use mass transit services including bus, rail transit and commuter rail. 10 percent reported commuting by carpool or vanpool. 17 percent of all area workers live fairly close by and reported that they usually walk to work.

Table 3.6

Study Area Workers:
Mode of Travel to Work
All Origins

Mode	Percent of Total
Drive Alone	43%
Walk	17%
Bus	13%
Rail Transit	12%
Carpool/Vanpool	10%
Commuter rail	2%
Bicycle	1%
Work at Home	1%
Other	1%
Total	**100%**

The 1990 Census also provides information about the work locations of individuals living along the Worcester corridor. In 1990, approximately 3,800 individuals living in this corridor worked in the study area. In order to evaluate the transportation mode used by these individuals, it was necessary to define an area surrounding each commuter rail station as a function of its potential utilization. Because commuters who live farther from the Central Business District (CBD) are willing to travel further to reach a commuter rail station, the following station catchment areas were defined:

Table 3.7

Worcester/Framingham Commuter Rail Line Station Areas

Stations	Radius from Station
Newtonville, West Newton	2 miles
Wellesley Farms to Wellesley Square	3 miles
Natick, West Natick	4 miles
Framingham to Worcester	5 miles

For those commuters living in this Corridor and commuting to the study area, the principal means of travel to and from work is either driving alone or carpooling, despite the fact that they live conveniently close to a commuter rail station. According to the census data, 68 percent of these commuters drive alone and another 11 percent carpool. Only 4 percent of commuters to the study area utilize commuter rail services. However, it is notable that a total of 16 percent travel by MBTA bus or rail transit services.

Table 3.8

Study Area Commuters from Communities on Worcester/Framingham Line

	Drive Alone		*Carpool/Vanpool*		*Bus*		*Rail Transit*	
	Commuters	**Percent**	**Commuters**	**Percent**	**Commuters**	**Percent**	**Commuters**	**Percent**
Worcester	34	54%	17	27%	5	8%	0	0%
North Grafton	5	100%	0	0%	0	0%	0	0%
Westborough	36	100%	0	0%	0	0%	0	0%
Southborough	20	69%	9	31%	0	0%	0	0%
Ashland	46	57%	9	11%	0	0%	0	0%
Framingham	328	80%	33	8%	0	0%	17	4%
West Natick	193	75%	41	16%	0	0%	8	3%
Natick	267	82%	37	11%	0	0%	8	2%
Wellesley Square	133	73%	32	18%	7	4%	0	0%
Wellesley Hills	154	81%	18	9%	8	4%	0	0%
Wellesley Farms	89	68%	29	22%	8	6%	0	0%
Auburndale	206	60%	51	15%	18	5%	63	18%
West Newton	370	72%	40	8%	23	4%	63	12%
Newtonville	735	57%	112	9%	372	29%	36	3%
Total	**2616**	**68%**	**442**	**11%**	**441**	**11%**	**195**	**5%**

Table 3.8 (continued)

Study Area Commuters from Communities on Worcester/Framingham Line (continued)

	Commuter Rail		*Other*		*TOTAL*
	Commuters	**Percent**	**Commuters**	**Percent**	**Commuters**
Worcester	0	0%	7	11%	63
North Grafton	0	0%	0	0%	5
Westborough	0	0%	0	0%	36
Southborough	0	0%	0	0%	29
Ashland	26	32%	0	0%	81
Framingham	32	8%	0	0%	410
West Natick	15	6%	0	0%	257
Natick	15	5%	0	0%	327
Wellesley Square	10	5%	0	0%	182
Wellesley Hills	10	5%	0	0%	190
Wellesley Farms	4	3%	0	0%	130
Auburndale	4	1%	0	0%	342
West Newton	12	2%	7	1%	515
Newtonville	16	1%	15	1%	1286
Total	**144**	**4%**	**29**	**1%**	**3,853**

In 1993, the Central Transportation Planning Staff conducted an MBTA system-wide commuter rail passenger survey. This survey was performed on a weekday morning and therefore provides information about typical commuting patterns for individuals utilizing commuter rail services. The data collected provides additional information about the number of commuters boarding the Worcester line with final destinations in the Fenway/Longwood area.

Table 3.9

Number of Individuals Using Commuter Rail to Reach Destinations in the Study Area

	Number of Passengers Travelling to Fenway	
Station	**1990 Census**	**1993 Passenger Survey**
Worcester	0	19
Framingham	32	57
West Natick	15	32
Natick	15	20
Wellesley Square	10	11
Wellesley Hills	10	2
Wellesley Farms	4	0
Auburndale	4	2
West Newton	12	6
Newtonville	16	24
Total	**144**	**173**

Source: 1993 MBTA Systemwide Commuter Rail Passenger Survey

Table 3.9 shows that data provided by the census and the passenger survey are fairly consistent. Only a small number of commuters to the study area from the Worcester/Framingham line currently use commuter rail as their mode of travel. According to the 1990 Census, 3,853 persons commute from the corridor to the study area. According to these data, the 1990 potential market for new transit riders that could be diverted from driving alone in their automobile is approximately 2,600 commuters.

Future Growth in the Study Area

The current intensity of interest regarding full-time service to Fenway/Kenmore area largely stems from planned developments in the study area that will intensify the density of land use in the study area. Several specific developments underway or proposed for the area will tend to increase travel to and from the study area.

Table 3.10

Future Growth in the Study Area	
Area	**Development**
Kenmore Square	Hotel Commonwealth: A new hotel of nearly 200,000 square feet is planned
Fenway	Landmark Center: Renovation and expansion of the long empty Sears complex as the Landmark Center will add 1.35 million square feet of mostly office, retail and cinema space to the study area. Boylston Square: will add one million more square feet of residential, hotel and cinema space to the study area Red Sox Fenway Park: will add a hall of fame type museum to the study area and develop a replacement ballpark with approximately 10,000 more seats than the current facility. 1,700 surface parking spaces will be replaced with 2,000 parking spaces in two structures.
Longwood	Longwood Medical Area institutions have recently announced plans to build several new buildings adding two million square feet of additional office and clinical space.

Information on some of these specific developments was blended with CTPS's 1996 projections of year 2020 land use for the study area to yield estimates of future land use, population, and employment as shown in Tables 3.11 and 3.12 below.

Table 3.11

2020 Projected Built Environment (000's of square feet)						
Sub Area	**Total Floor Space**	**Residential**	**White Collar**	**Schools**	**Retail**	**Blue Collar**
Kenmore Square	7,799	3,793	1,524	2,059	360	63
Fenway	17,523	10,107	4,556	496	1,252	1,111
Longwood	10,717	1,177	4,689	2,676	189	1,985
Total	**36,038**	**15,077**	**10,769**	**5,232**	**1,801**	**3,159**

Based on CTPS 2020 projections with adjustments for specific projects summarized above.

Based on these forecasts, total floor space in the study area is projected to increase by approximately 18%. However, the mix of uses will change with residential use increasing much more slowly than office space. Overall, residential use will increase by 5% while white collar

office-related employment will increase by 38%. Overall development in non-residential use is expected to increase by 28%.

The study used the projected built environment for 2020 and the 1996 employment and built environment figures to projected 2020 employment. The ratio of square footage per employee was kept constant from 1996 actual data to the 2020 projections. Using this method there is a projected increase of 10,752 total employees. This represents future growth of almost 25 percent. The most marked growth occurs in the Fenway sub-area, projected to increase of about 38 percent. A more modest increase of 23 percent is forecast for Kenmore. Anticipated growth of 22 percent is shown at Longwood. Employment increases in most categories of economic activity, especially white collar employment which is anticipated to grow by 28%. Blue collar industry may experience a decrease of 1.2 percent.

Table 3.12

2020 Projected Employment					
Sub Area	**Total Employment**	**White Collar**	**Schools**	**Retail**	**Blue Collar**
Kenmore	11,599	3,385	6,473	1,245	496
Fenway	9,715	5,334	647	2,787	946
Longwood	32,656	28,939	2,595	281	841
Total	**53,970**	**37,659**	**9,715**	**4,313**	**2,283**

Based on 2020 land use projections with constant ratio of employees/sq. ft. from 1996.

Consultation with local officials in the study area indicates that the development and employment projections for the study area are conservative.

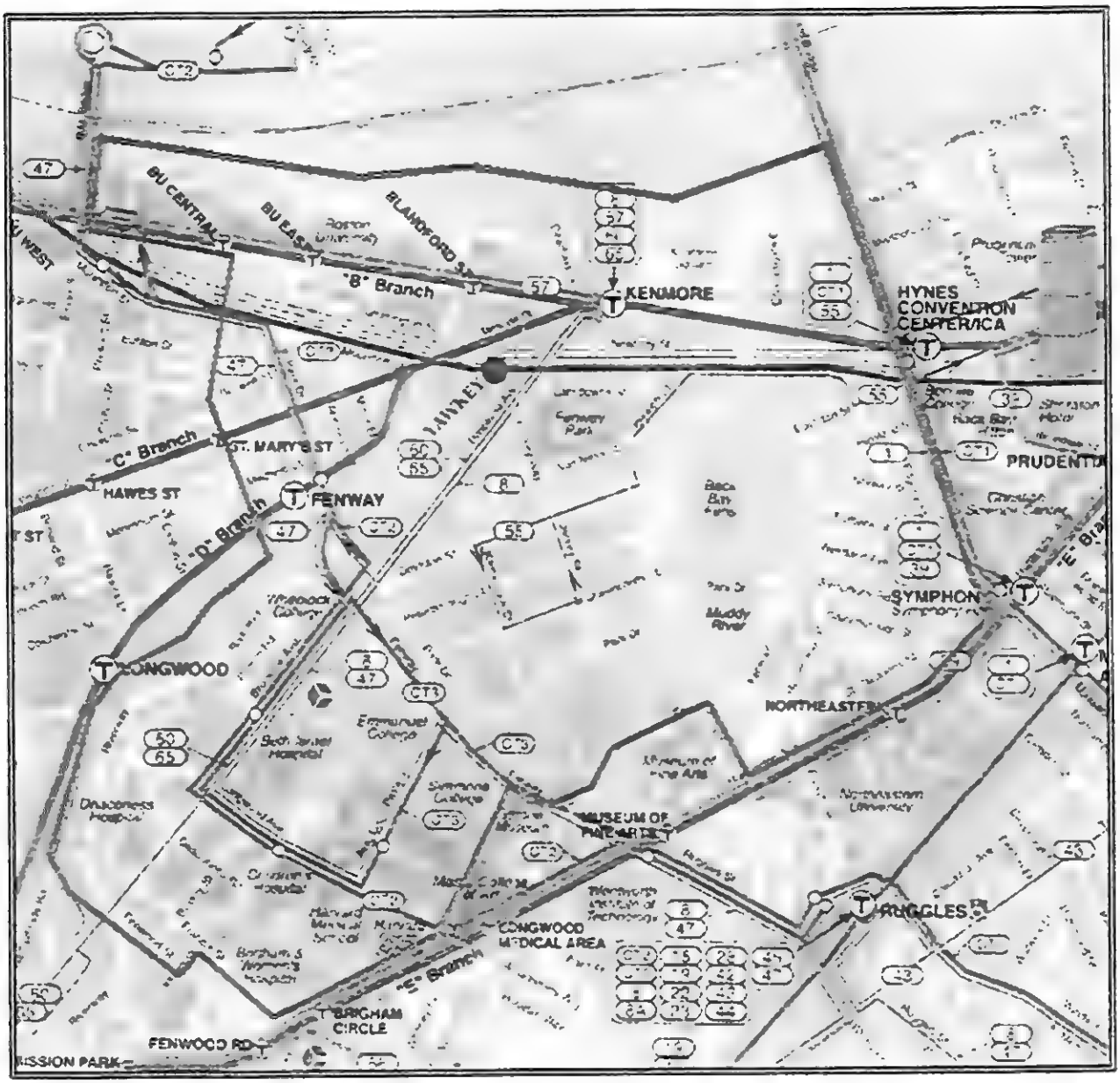


Figure 4.2
MBTA Transit Network in the Study Area

The Green Line experiences over 200,000 boardings each weekday. Of these daily boardings, 20,387 occur on the Riverside Line (D Line) and 10,765 occur on the Heath Street line (E Line).

CHAPTER 4
PUBLIC TRANSIT SERVICES IN THE STUDY AREA

The study area is served by all branches of the MBTA's Green Line and by twelve MBTA bus routes. This chapter describes the existing public transit services in the study area.

Definitions

This chapter refers to boardings, alightings and trips.
A boarding or alighting represents a one way passenger trip to or from a particular station.
The term trip refers to a daily round trip to/from the study area.

Green Line Service

The MBTA operates light rail vehicles on a network of 78 miles of subway and surface track on the four branches of the Green Line which feed into the central subway in downtown Boston.

The study area is served by all four branches of the Green Line. Heading west, the B Line leaves Kenmore Station and serves Blandford Street Station and two BU stations before leaving the study area. The C Line also branches westward from Kenmore Station, making one additional station stop in the study area at Saint Mary's Street Station. Headed southwesterly, the D Line diverges from the C Line near Yawkey Station. It makes one more station stop at Fenway before it leaves the study region. The E Line, which diverts from the Green Line's Central Subway at Copley Station, frames the southern region of the study area with five station stops on the line that serves the Fenway/Kenmore/Longwood area. (See Figure 4.2)

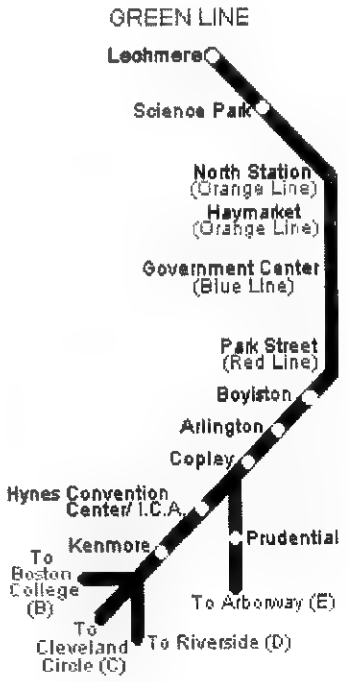


Figure 4.1

Table 4.1

Green Line Ridership		
Branch	**Weekday Boardings**	**Number of Stations**
Central Subway	127,182	11
Boston College (B Line)	29,393	22
Cleveland Circle (C Line)	13,842	13
Riverside (D Line)	20,387	13
Heath Street (E Line)	10,765	11
Total Green Line	**201,539**	**70**

Source: MBTA, Ridership and Service Statistics, CTPS 1995/1997 Counts

Even though the B and C Lines of the Green Line serve the study area, these stations are not very heavily used for study area trips. This is due to several circumstances: First, there is a high frequency of Green Line service at Kenmore Station. Second, there is a relatively reduced frequency of service at Blandford Station (B Line) and Saint Mary's Street (C Line). Finally, the D and E Lines are better oriented to serve the major activity centers in the study area than are the B and C Lines. In considering light rail service to the study area this report primarily focuses on the D and E Lines of the Green Line.

D Line
Scheduled running times during the peak hours between Riverside and Kenmore Station are 41 minutes inbound and 45 minutes outbound. Service on the Riverside Line operates at five-minute intervals during the peak period.

E Line
The Heath Street Line branches from the central subway line at Copley Station, and has two more underground stops before it reaches the surface. The line then runs down the median of Huntington Avenue with numerous stops on its route. The line runs in mixed traffic in the street from Brigham Circle to Heath Street. Peak hour service is offered every nine minutes in both directions.

Green Line Stations with Heaviest Passenger Volumes
There are several Green Line stations on the D and E lines serving the study area. The most prominent of these stations for commuters to the study area are Kenmore, followed by Fenway and Longwood on the Riverside Line, and Northeastern, Longwood Medical Area, Brigham

Table 4.3

Connecting Bus Routes at Kenmore Station		
Route Number	**Route**	**Peak Headway (minutes)**
8	Harbor Point / U. Mass to Kenmore Station	20
57	Watertown to Kenmore Station	6
60	Chestnut Hill to Kenmore Station	18
65	Brighton Center to Kenmore Station	25

Figure 4.5: Longwood Station
Source: MBTA Website

Longwood Station is located on the Riverway near Longwood Avenue and is approximately one-half mile from the current Yawkey Station. Approximately 1,500 people board the Riverside Line at Longwood Station to travel inbound and more than 2,500 people alight at Longwood from both the inbound and outbound directions. Approximately 1,100 people board at this station in the outbound direction. There are no connecting bus services at Longwood Station.

Longwood Medical Area – Longwood Medical Area on the E Line serves a similar function as the Longwood station on the D Line. The stop is located on the junction of Huntington Avenue and Longwood Avenue. Approximately 2,300 people board the Heath Street line on the inbound side at Longwood Medical and nearly 2,700 passengers board from the outbound side, with a total boarding of almost 5000 people daily.

Table 4.4

Connecting Bus Routes at Longwood Medical Area		
Route Number	**Route**	**Peak Headway (minutes)**
39	Forest Hills Station to Back Bay Station	4
CT-2	Kendall Square to Ruggles	20

Brigham Circle – Brigham Circle is also located on the E Line, and is the next stop on the outbound line after Longwood Medical Area. The station is located at the corner of Huntington Avenue and Francis Street. The Route #39 Forest Hills bus and the Route #66 Harvard Square bus both provide frequent service between this station stop and the Orange, Red, and Commuter lines.

Table 4.5

Connecting Bus Routes at Brigham Circle		
Route Number	**Route**	**Peak Headway (minutes)**
39	Forest Hills Station to Back Bay Station	4
66	Harvard Square to Dudley	10

Figure 4.6: The Landmark Center (Formerly Sears Roebuck)

Figure 4.7: Light Rail Vehicles at Fenway Station

Fenway Station is the easternmost surface station on the D Line. It is located on Park Drive and is approximately one-third of a mile from both the existing Yawkey Station and Fenway Park. The station is located next to the old Sears Roebuck Building, which is currently being renovated into a commercial property, the Landmark Center. An abandoned railroad right-of-way separates the station from the former Sears building.

More than one thousand people board the D Line at Fenway to travel inbound each day. Close to two thousand people alight at the station, from both the inbound and outbound direction. The peak travel time between Fenway Station and Park Street is approximately 14 minutes. Peak travel time between Fenway and South Station is approximately 19 minutes with a transfer to the Red Line. Two bus routes, the 47 and the CT-2, provide connections from the station to other communities and to the Red and Orange lines.

Table 4.6

Connecting Bus Routes at Fenway Station on Riverside Branch		
Route Number	**Route**	**Peak Headway (minutes)**
47	Central Square to Albany Street (South End)	20
CT-2	Kendall Square to Ruggles	20

The 1994 MBTA Systemwide Rapid Transit Passenger Survey provides information about the final destinations of individuals boarding at various stations along the Riverside Line. According to this survey, almost 900 people board each day at stations between Riverside and Chestnut Hill for destinations within the Fenway area. It is most likely that these individuals drove and parked at these stations or were dropped off and then boarded at the station.

Fare Collection

Fares on the Green Line are generally collected onboard the vehicle at above ground stations and at turnstiles when operating in the central subway. The one-way fare between Kenmore and Lechmere is 85 cents. The inbound fare for passengers boarding at the surface stations between Reservoir through Fenway stations on the Riverside Line is $1, and the fare for passengers boarding at points west of Reservoir is $2. Outbound passengers boarding on the surface pay no fare. Monthly passes for unlimited travel on the Riverside Line from Reservoir inward are $27. For unlimited travel on the entire Riverside Line, a combination pass must be purchased at a cost of $46.

Local Bus Service

Twelve MBTA local routes serve the study area. These routes are cross-town or semi-circumferential routes which provide for mobility to destinations other than Downtown Boston including connections to the Red, Orange, and Green Lines. Daily boardings on these twelve routes total more than 67,000 daily trips.

September 1999 daily boardings within the study area for these twelve routes totalled 13,188 daily trips - 9,024 of which travelled to points beyond the study area[1].

Figure 4.8: Bus in Kenmore Square

[1] D. Carney MBTA Operations Planning September 1999

Circle and the Museum of Fine Arts on the Heath Street Line. Ridership statistics for these stations, shown in Table 4.2, is sorted by total volume of boardings.

Table 4.2

Daily Boardings and Alightings at Green Line Stations With Heaviest Passenger Volumes

Station	Lines Served	Inbound		Outbound	
		Boardings	*Alightings*	*Boardings*	*Alightings*
Kenmore	B, C, D	5,068	2,737	3,002	4,993
Longwood	D	1,441	1,223	1,095	1,446
Northeastern	E	2,086	360	921	1,817
Longwood Medical Area	E	2,301	67	199	2,329
Brigham Circle	E	1,694	30	152	1,853
Fenway	D	1,061	564	684	1,284
Museum of Fine Arts	E	1,265	76	238	1,187
Total		**14,916**	**5,057**	**6,291**	**14,909**

Total daily boardings and alightings at these seven large stations equals approximately 41,000 one way passenger trips.

The stations are discussed below in order of their total boardings and alightings.

Kenmore Station –The B C and D Lines converge in the central subway at Kenmore Square. Approximately 8,000 people board the Green Line at Kenmore Station daily. Alightings at the station total close to 7,000 per day. The travel time between Kenmore and Park Street is 10 minutes. Travel time between Kenmore and South Station is 15 minutes with a transfer to the Red Line.

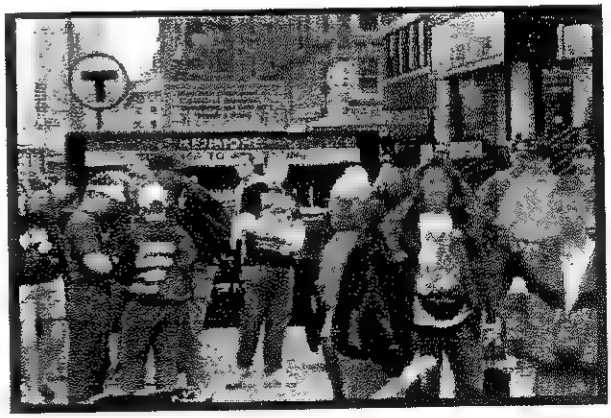


Figure 4.3: Kenmore Square

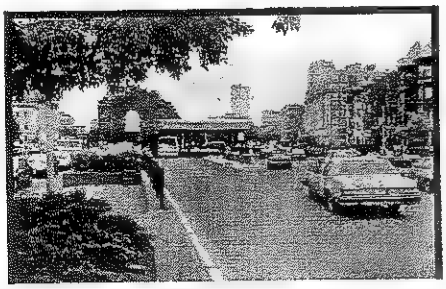


Figure 4.4: Bus Terminal at Kenmore Station

Kenmore Station is also the terminus of four MBTA bus routes, which provide service to Watertown, Brighton, the South End, and Brookline. Route 8 from South Boston to Kenmore serves the Longwood Medical Area. Routes 57, 60 and 65 provide express services from Watertown, Newton and Brighton to the study area primarily for connections to the Green Line.

Four bus routes serving the study area do not stop at a Green Line station.

Table 4.7

Local Bus Routes That Do Not Connect with the Green Line		
Route Number	**Route**	**Peak Headway (minutes)**
1	Harvard/ Holyoke Gate to Dudley Station	7
55	Queensberry to Copley Square/Park & Tremont Streets	30
CT-1	Central Square to B.U. Medical Center	15
CT-3	Beth Israel Hospital to Andrew	20

The one-way fare for MBTA local bus service is $0.60. A monthly pass valid for unlimited local bus travel costs $20. Total cash fare for a local bus ride plus a subway ride is $1.45. A monthly pass valid for unlimited travel on both local buses and most subway rides costs $46.

Table 4.8

MBTA Bus Routes Within The Study Area				
Route Number	**Route**	**Peak headway (minutes)**	**Average Daily Boardings**	**Notes**
1	Harvard/ Holyoke Gate to Dudley Station	7	12,557	Connects with Red, Orange, and Green Lines
8	Harbor Point /U. Mass to Kenmore Station	20	5,270	Connects with Orange and Green Lines
39	Forest Fills Station to Back Bay Station	4	17,405	Connects with Green and Orange Lines and Commuter Rail
47	Central Square to Albany Street (South End)	20	3,625	Connects with Red, Green, and Orange lines
55	Queensberry to Copley Square/Park & Tremont Streets	30	916	Connects with Green and Red Lines
57	Watertown Square to Kenmore	6	4,272	Runs "limited" from Packard's Corner to Kenmore
60	Chestnut Hill to Kenmore	18	1,619	Connects with Green Line
65	Brighton Center to Kenmore	25	1,683	Connects with Green Line
66	Harvard Square to Dudley Station	10	11,151	Connects with Orange, Red, and Green Lines
CT-1	Central Square to B.U. Medical Center	15	2,192	Connects with Orange, Red, and Green Lines
CT-2	Kendall Square to Ruggles Station	20	1,208	Connects with Red, Green, and Orange Lines
CT-3	Beth Israel Hospital to Andrew	20	1,017	Connects with Red, Green, and Orange Lines

Source: MBTA Operations Planning

Planned or Proposed Changes in MBTA Service

Three pending changes in MBTA services have potential impact on the study area: Type 8 Green Line vehicles, the Green Line Operations Study, and the Urban Ring Major Investment Study.

New Green Line Vehicles - The MBTA is in the process of acquiring a new fleet of Type 8 "low floor" vehicles for the Green Line. The MBTA plans to operate the Type 8 vehicles along with the existing Type 7 vehicles, which currently make up the majority of the active Green Line fleet. The Type 8 vehicles will have three effects on Green Line operations:

- They will be ADA-compliant accessible for persons in wheelchairs and other persons who have difficulty with stairs. The lower floors of the Type 8 cars should enable more rapid entry and exit. This should shorten the dwell time at each stop and reduce overall trip time.

- They will enable retirement of the aging (late 70's) Boeing vehicles. A fleet composed of more contemporary vehicles should reduce service delays and reduce uncertainty in trip time and schedule headway.

- They will increase the fleet of available cars allowing the MBTA to consider operating three-car trains. This would reduce passenger congestion within the cars and provide means for a more rapid entry and exit from less-congested cars.

Green Line Operations Study – The MBTA is currently reviewing Green Line operations to evaluate capital and operating strategies that may improve capacity and reliability of the Green Line, especially the Central Subway between Kenmore and Lechmere.

Urban Ring - The Urban Ring Major Investment Study (MIS) analyzes a proposed circumferential transit system looping around downtown Boston roughly from Dorchester to Logan Airport via Brighton. This service would intersect with every existing subway and commuter rail line located a distance from downtown. It would provide riders with an alternative to the hub-and-spoke system that requires some riders to travel inbound on one line to downtown and then travel outbound on another line to their destination. The Major Investment Study is evaluating the potential of different modes and alignments for best making these connections.

The MBTA's recently introduced cross-town bus routes, the CT-1, CT-2, and CT-3, are forerunners of this concept.

Alternatives under consideration for the Urban Ring MIS involve the eastern edge of the study area -- crossing the Charles River near the BU Bridge or near Kenmore Square. The two proposed points for intersection between the Urban Ring and Worcester/Framingham line are described in Chapter 5 on Station Siting, Operations and Scheduling.

CHAPTER 5
STATION SITING, OPERATIONS AND SCHEDULING

INTRODUCTION

This chapter reviews potential sites and operating strategies that would be appropriate for full-time commuter rail service to the study area by MBTA trains running between Worcester/ Framingham and Boston's Back Bay and South Stations. The introductory segment provides a discussion of design criteria and historical background. The second section discussing station siting alternatives describes the opportunities and challenges that would be presented at the two most promising sites for the development of full service to the Fenway/Kenmore area. The third section on operations and scheduling presents a similar discussion of operating and scheduling challenges that would be faced with the expansion to full-time commuter rail service to the study area.

Physical and Operational Design Criteria

In evaluating station design and schedule options for full-time service to the Fenway/Kenmore area, several criteria were applied.

1. Minimize impacts on existing MBTA customers and services.
2. Minimize potential for conflict between freight and passenger rail services.
3. Maximize service to the Fenway/Kenmore study area.
4. Avoid realigning track.
5. Avoid conflicts with overhead bridge abutments and the Turnpike.
6. Avoid land takings.

Historical Background

Yawkey Station is located at the historic junction of the Boston and Albany's (B&A) Main Line and its Highland Branch. In the late 1950's, the Highland Branch was converted from a steam railway to electrified light rail. Today, it is the D Line of the MBTA Green Line. Soon after, the

Massachusetts Turnpike Authority acquired the B&A Main Line between Boston and Riverside (Milepost 11) to build the Turnpike Extension, which is built in the former rail right-of-way. When work on the new highway began there were no passenger stations between Allston and Back Bay.

In the first quarter of the last century, the Beacon Street Station had been operated at the approximate site of the current Yawkey Station. This passenger station was located at the junction of the B&A Main Line and the Highland Branch, and it served both lines. This station was abandoned prior to 1936.

Until the light rail conversion of the Highland Branch, the current Fenway Station did not exist. Instead there was a commuter rail station called Chapel east of the current Longwood Station. Before the conversion to light rail, many trains were operated in a unique circuit configuration between the Main Line and the Branch. In this configuration, trains would operate in both directions around a 22-mile loop between Boston and Riverside. One leg of the loop was the Main Line, and the other leg was the Highland Branch.

Yawkey Station Today
The current Yawkey station is designed for limited use. It serves only one of the two main tracks on the railway, and it has a short 200-foot platform. A photo of the current platform is found in Figure 5.1

Figure 5.1: Existing Yawkey Station looking eastward towards Boston

Site Constraints
Platform on one track only – The current site has a platform on only Track Two (the South Track).

Platform length - The current station has a limited platform length with 200 feet of low platform and a mini high-level platform for handicap access. With this short length, the station can only berth two coaches at a time. To minimize impacts on existing MBTA rail customers, a full service station would require a much longer platform (MBTA standard minimum is 765 feet). Dwell times are affected when only a fraction of the coaches on a train can be berthed at a platform.

Platform height - High-level platforms are preferred since they reduce dwell times, improve accessibility for mobility-impaired passengers, and improve overall customer service.

A longer low-level platform with a mini high-level platform for handicapped accessibility at Yawkey Station site would not be acceptable to the MBTA. CSX agreed to consider a high-level platform on Track Two with an accompanying universal crossover east of the station site. This

crossover would reduce the impact of commuter rail passenger service on the freight service that is currently operated in the area.

Station Site Alternatives

A preliminary review of potential station sites for full-time commuter rail service identified two likely alternative sites to be served by trains travelling between Worcester/Framingham and Boston. (See Figure 5.2) The sites were identified by the study team during field inspections, and then confirmed by the MBTA's Urban Ring Project team that is also evaluating potential commuter rail station sites in the Fenway/Kenmore area. The Urban Ring Project has studied both sites.

- Eastern alternative is at current Yawkey Station between Brookline Ave and Beacon Street.
- Western alternative is between Beacon Street and Saint Mary's Street.
- A station east of Brookline Avenue Street was deemed infeasible due to the need for a land taking from the north side of properties facing Lansdowne Street.

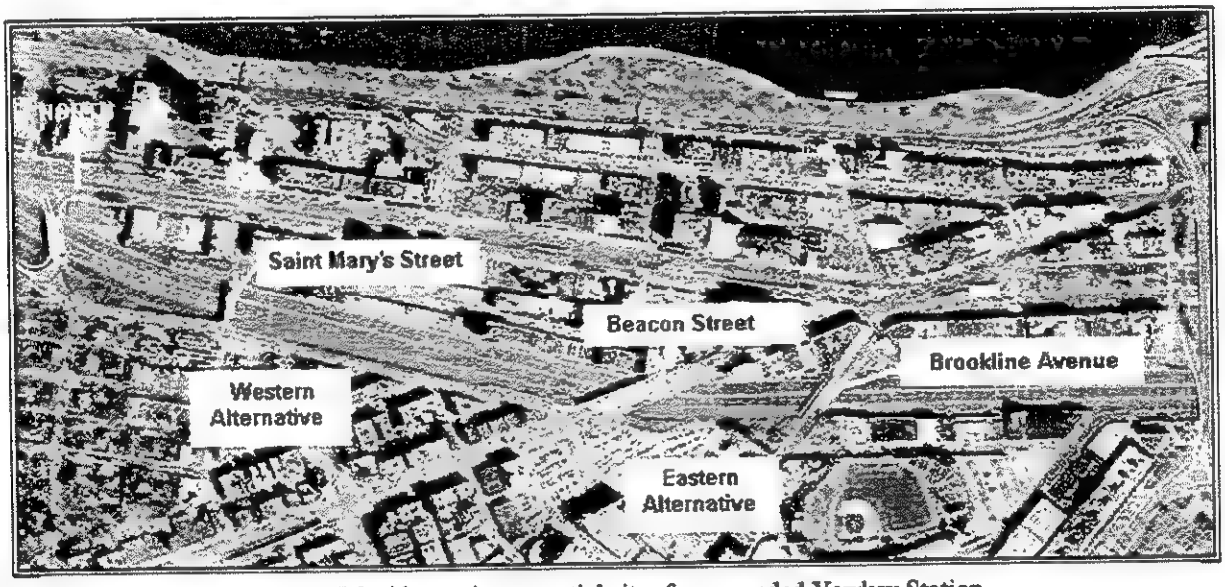


Figure 5.2: Alternative potential sites for expanded Yawkey Station

Both site alternatives are described below and evaluated with specific reference to the six physical and operational design criteria listed above. The sites are also evaluated using five site selection criteria:

1. Relation to major transit nodes
2. Compatibility with existing land use
3. Joint development opportunities
4. Impact on sensitive receptors
5. Ease and cost of construction

Eastern Alternative:
Expand Current Yawkey Station
East of Beacon Street

The site of the current station between Beacon Street and Brookline Avenue is conveniently located relative to Kenmore Square on the main North-South Axis of the study area. (See Figure 5.3) From an urban design perspective, this site would be superior for access to major destinations and as a focal point for future growth in the area.

Several physical design and operational concerns that would need to be addressed surfaced in the preliminary review during the station siting and feasibility analysis.

1. Platform Length

The railway access between Beacon Street and Brookline Avenue is only 700 feet long. The minimum standard MBTA commuter rail platform is 765 feet in length. A platform length of at least 800 feet is desired. Informal inspection of the Beacon Street overpass indicates that an 800-foot platform could be built by extending the platform beneath the Beacon Street overpass. Due to the location of the bridge abutment, the portion of the platform under the bridge would be narrower than the standard platform depth of 10 feet but, at 6 – 8 feet, would be usable.

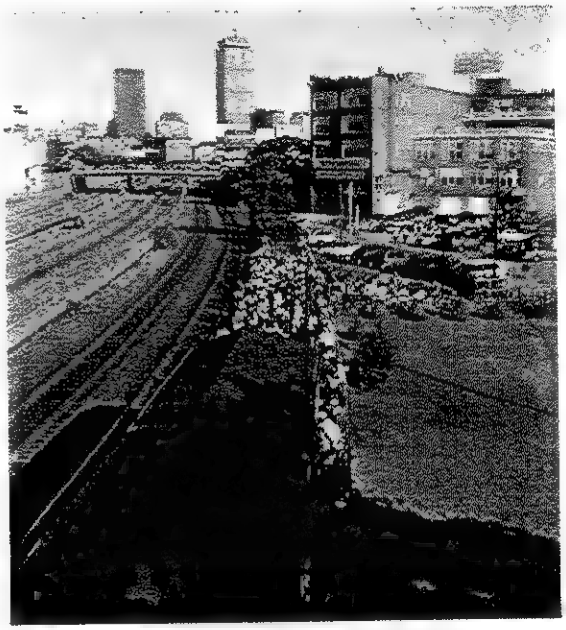


Figure 5.3: Yawkey Station looking eastward from the Beacon Street overpass

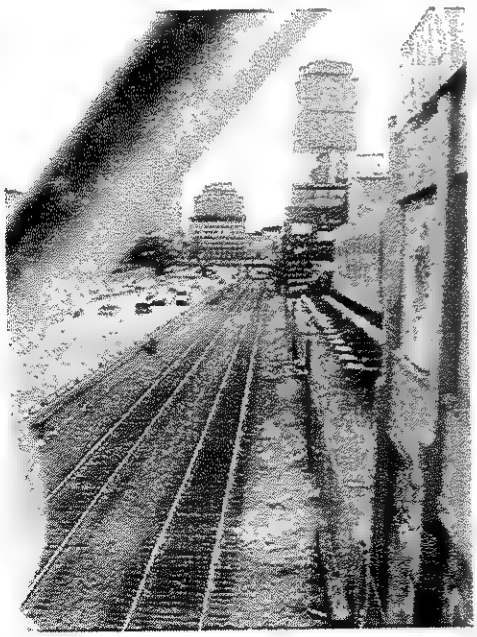


Figure 5.4: View from Brookline Avenue overpass eastward to Boston

A similar informal inspection of horizontal clearances under the Brookline Avenue Bridge found that a platform extension under the Brookline Avenue Bridge would be infeasible without relocating track or reconstructing bridge supports. There is simply insufficient lateral clearance under the Brookline Avenue Bridge to build a platform. East of the bridge, there does not appear to be sufficient right-of-way to construct station platforms without a land taking from the abutting commercial buildings. (See Figure 5.4)

The team also determined that if a low platform is built under the Beacon Street overpass, the mini high-level platform on the west end of the existing platform could be relocated immediately west of the overpass. The available right of way south of the tracks at this location is quite wide.

2. Curvature

There is a curve in the rail line as it passes under Beacon Street. (See Figure 5.5) Stations on curves are generally not favored. In particular, high-level platforms are a problem on curves since the gap between the coach doors and the edge of the platform could be unacceptable if the radius of curve is too tight. The curve at Beacon Street, however, is relatively gentle (2.5 degrees). Consultations with MBTA design and engineering officials indicate that a high-level platform could be built on Track Two on the outside of the curve.

3. Platform on Track One

Inspection of the right-of-way between Track One and the turnpike indicates that there is insufficient room on this track to construct a station platform without realigning track or encroaching on the highway.

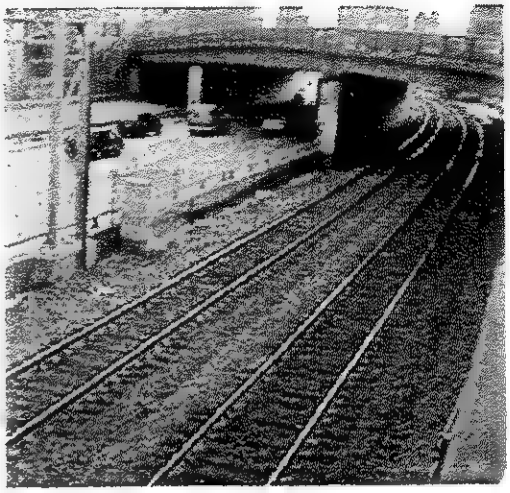


Figure 5.5: The Curve:
Looking eastward from Mountfort Street
under the Beacon Street overpass

4. Conflict with Other Proposed Development

As evidenced by the successful development of Back Bay and South Station Transportation Centers, air rights developments above and adjacent to diesel railway stations can be compatible and complimentary to the station. However, two potential conflicts should be considered early for the eastern site. First, construction of a station under or near a building can raise the costs of station development and operation. In this initial feasibility report, such costs could not be determined reliably and are not estimated here. Second, the MBTA is reluctant to site a station platform at which diesel locomotives would dwell in an enclosed chamber. If the proposed BU Science building is built west of Beacon Street, the expanded Yawkey Station platform(s) would need to be shifted westward to allow the locomotives on the west end of the train to "hang" out of the building.

With respect to the proposed Urban Ring transit project, the Eastern Alternative would serve the Urban Ring fixed guideway transit line if any of the proposed Kenmore alignments were selected. The Kenmore alignments offer a direct connection to Kenmore Station, but bypass some important sites in Cambridge. The Kenmore alignments would cross the Charles River Basin in a tunnel and would be more expensive to build than the western BU alignments that could use the existing rail bridge corridor to cross the Charles.

Relative to the site selection criteria:

1. The eastern alternative is close to the major transit node at Kenmore Square.

2. A destination station at this location would be compatible with existing commercial and institutional land uses.

3. The site offers joint development opportunities with the Massachusetts Turnpike's air rights parcels and with other commercial/institutional development.

4. The site would be relatively remote from most homes and therefore fairly isolated from sensitive receptors.

5. The cost of constructing an 800-foot single station platform at this site would not involve any extraordinary costs.

Western Alternative:
East of Saint Mary's Street
The western alternative is located between Beacon Street and Saint Mary's Street. This alternative is less convenient to Kenmore Square and is "off-axis" to the study area's main North-South spine (Brookline Avenue), making it less desirable from an urban design perspective. However, from a physical design perspective, this site is more generously proportioned and tractable for the development of a full-length station.

1. Platform Length
The railway west of Beacon Street runs for more than 1000 feet before there are any significant horizontal clearance issues at Track Two.

2. Curvature
The railway between Beacon Street and Saint Mary's Street is tangent (straight). (See Figure 5.6)

3. Platform on Track One
Informal inspection of the right of way between Track One and the turnpike indicates the possibility of adeqiate room to construct a station platform without realigning track or encroaching on the highway. There would clearly be sufficient room if the break down lane that begins immediately east of Saint Mary's Street was shortened or shifted to the east.

4. Access to Brookline Avenue and Kenmore Square - The principal challenge presented by this site is access to the Kenmore Square and Brookline Avenue spine. Access could potentially be facilitated by constructing a headhouse east of Beacon Street that would connect with the station platform west of Beacon Street via an under-grade pedestrian tunnel running under the roadway. Such a passageway already exists in rough form under Beacon Street.

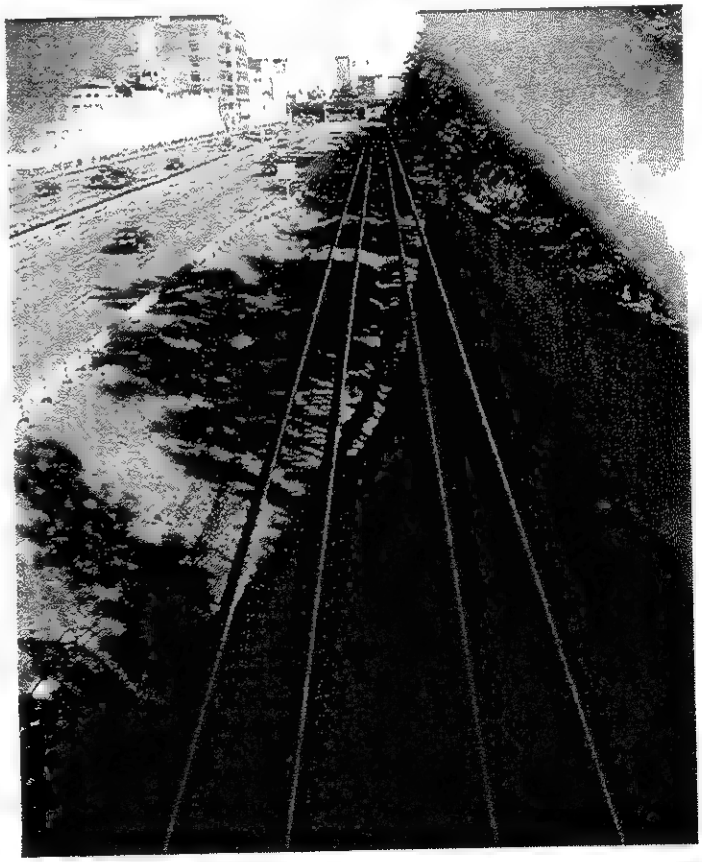


Figure 5.6 View from St Mary's Street Bridge looking East

The two abutments that support the southern end of the Beacon Street overpass create this passageway. The more northern abutment supports the steel beams that span the Turnpike and provides relatively tight clearance to Track Two. The more southern abutment appears to predate the turnpike. It acts as a retaining wall and supports a short span of bridge between it and the more northern abutment.

With respect to the proposed Urban Ring transit project, the western alternative would serve the Urban Ring fixed guideway transit line if any of the proposed BU alignments were selected. The BU alignments would cross the Charles River Basin via the existing rail bridge corridor and follow Saint Mary's Street southward to make connections with the C and D Lines of the Green Line at Saint Mary's and Fenway Stations respectively.

Relative to the site selection criteria:

1. The western alternative would be more remote from the major transit node at Kenmore Square.

2. The destination station would be compatible, but not complimentary to the institutional and residential nature of the surrounding neighborhood.

3. The joint development opportunities at this site would be predominantly institutional.

4. The potential for impacts on sensitive receptors at this location would be increased since most of the station would face homes and residences.

5. Construction of a single-track station would be relatively straightforward. The cost of providing an access path to Brookline Avenue would be an added expense.

Site Selection Summary
The two alternative station sites are compared in Table 5.1

Table 5.1

Site Selection Matrix

Evaluation Criterion	Eastern Alternative		Western Alternative	
Relation to major transit nodes	+	Close to Kenmore Square	-	Relatively isolated
Compatibility with existing land use	+	Generally commercial/institutional setting compatible with destination transit station	-	Surroundings are more of an institutional/residential character.
Joint development opportunities	+	Location is proximate to growing commercial area	-	Joint development would be predominately institutional in character
Impact on sensitive receptors	-	Station is relatively remote from most homes but locomotive would dwell at Mountfort Street.	-	Station would face homes and residences on Mountfort Street
Ease and cost of construction		Construction on curve adjacent to proposed parking structures could be slightly more expensive		Construction of a platform on Track One would be relatively straightforward. Providing path of access from station to Brookline Avenue spine would add to expense.

Review of the evaluation matrix indicates that the eastern alternative is superior on transportation, land use and environmental considerations.

OPERATIONS AND SCHEDULING
If the current MBTA weekday service is adjusted to add a new stop in the study area for all commuter rail trains running between Worcester/Framingham and Boston, three principal operational concerns relating to the physical design criteria must be evaluated and addressed.

1. **Impact on Through Service** - What is the impact on operations and service for rail passenger travel between Boston and Worcester/Framingham?

2. **Number of Station Platforms** - Are two platforms required or can service be operated with a platform that only serves Track Two?

3. **High-Level Platforms** - Can a station be built that balances the passenger operations' needs for minimal dwell times and maximum accessibility against the freight operations' needs to accommodate oversize loads while retaining operating flexibility?

Each of these questions is addressed below.

1. Impact on Through Service

To evaluate the impact of full-time service to the study area on through service between Boston and the 16 existing, planned and proposed stations to the west on the Worcester/Framingham Line, impacts on travel times were estimated. The team used a computerized train-scheduling tool that synthesizes information on track speeds, station locations, equipment types, and dwell times to determine the times that should be allowed for MBTA commuter rail trains to complete a proposed trip.

The anticipated 2010 schedule described in Chapter 2 and Appendix A was adjusted to include a new station stop at Milepost 2.3 for 38 of the 42 anticipated trains. This includes all peak and off-peak trains. Only a few reverse peak trains (none in the morning) were scheduled to serve the proposed new station due to considerations discussed later in this chapter.

It was found that adding a Fenway/Kenmore stop to each of these trains would generally increase overall end-to-end travel times by two to three minutes for each trip. The forecast impact on service velocity (miles travelled/hours of travel) for AM peak trains is summarized in Table 5.2. At western stations, the impact on service velocity for morning peak trains is less than two miles per hour. Within Route 128, the impact on service velocity is more pronounced.

Table 5.2

Impacts of Fenway/Kenmore Service on Travel Time and Service Velocity by Station

STATION	Mile Post	Average Travel Time to Boston with New Station (H:MM)	Service Velocity with New Station (MPH)	Base Case Service Velocity (MPH)	Reduced Velocity (MPH)
Worcester	44.2	1:19	33.3	34.2	0.9
Millbury	39.3	1:11	33.1	34.0	0.9
Grafton	36.5	1:05	33.2	34.1	0.9
Westborough	33.9	1:00	33.4	34.4	1.0
Southborough	27.1	0:51	31.5	32.7	1.2
Ashland	24.5	0:46	31.6	32.9	1.3
Framingham	21.4	0:45	28.5	29.8	1.3
West Natick	19.9	0:45	26.5	27.7	1.2
Natick	17.7	0:40	26.3	27.6	1.3
Wellesley Square	14.7	0:35	25.0	26.5	1.5
Wellesley Hills	13.5	0:31	25.4	27.0	1.6
Wellesley Farms	12.5	0:28	25.9	27.8	1.9
Mass Pike	11.3	0:25	26.6	28.9	2.2
Auburndale	10.2	0:24	24.9	27.4	2.5
West Newton	9.1	0:22	24.4	27.3	2.8
Newtonville	8.1	0:19	25.0	28.4	3.4

The team found that only minor modifications were required in the anticipated 2010 timetable to accommodate a new Fenway/Kenmore stop. A copy of the anticipated 2010 timetable with study area stops included is found in Appendix A.

2. Number of Station Platforms

The station siting analysis indicated that providing a station platform that serves Track One would be a problematic and potentially very expensive undertaking. Consequently, the team was interested in the possibility of a one-track station that will serve only Track Two. The study team used the scheduling tool to determine what potential conflicts would be created, and what trains would be prevented from serving the study area if the proposed new station were served on only Track Two.

In thinking about routing all service to the proposed new station via Track Two, note that the two closest interlockings allowing passenger trains to change tracks are:

- Cove at Milepost 1.1. Cove lies immediately east of Back Bay Station. This interlocking is approximately 1.3 miles east of the current Yawkey Station.
- CP3 at Milepost 3.1. CP3 is approximately 0.8 miles west of the current Yawkey Station. This interlocking is the eastern entrance to the Beacon Park Yards.

For reference, an annotated aerial photograph showing the 4.8 miles of railway corridor between South Station and the west end of Beacon Park Yards (CP4) is shown in Figure 5.7.

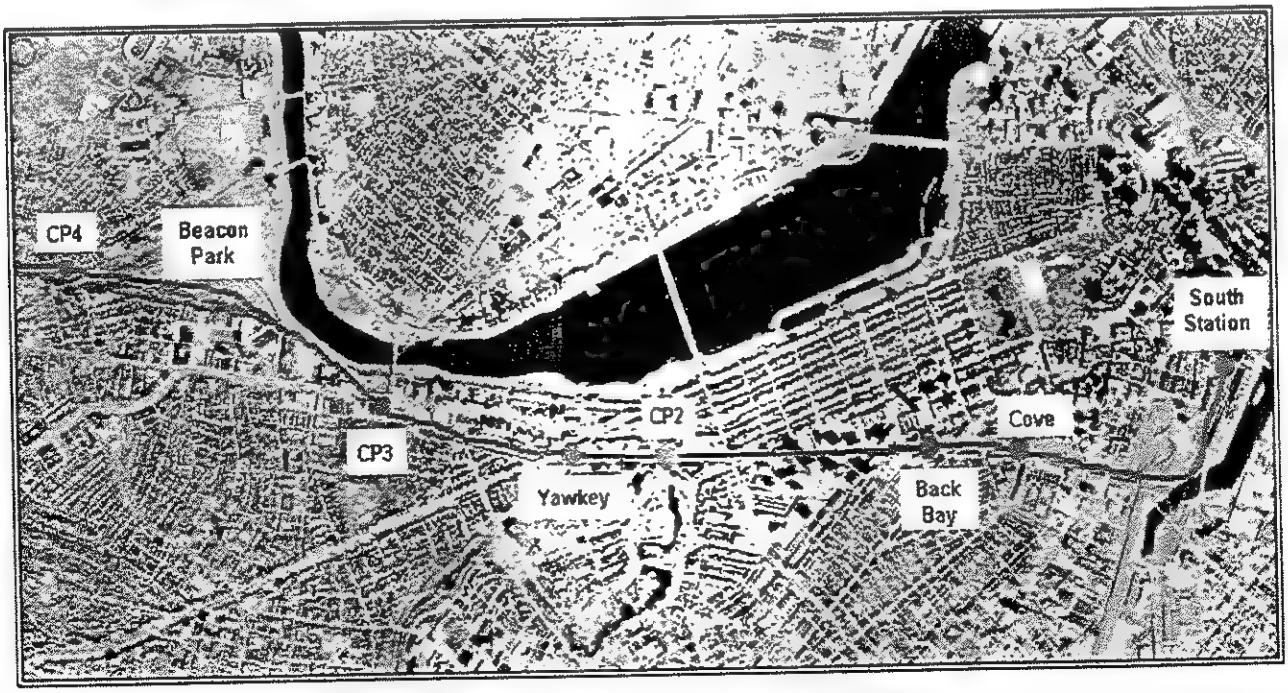


Figure 5.7 Annotated Aerial Photograph of Rail Line in Boston.

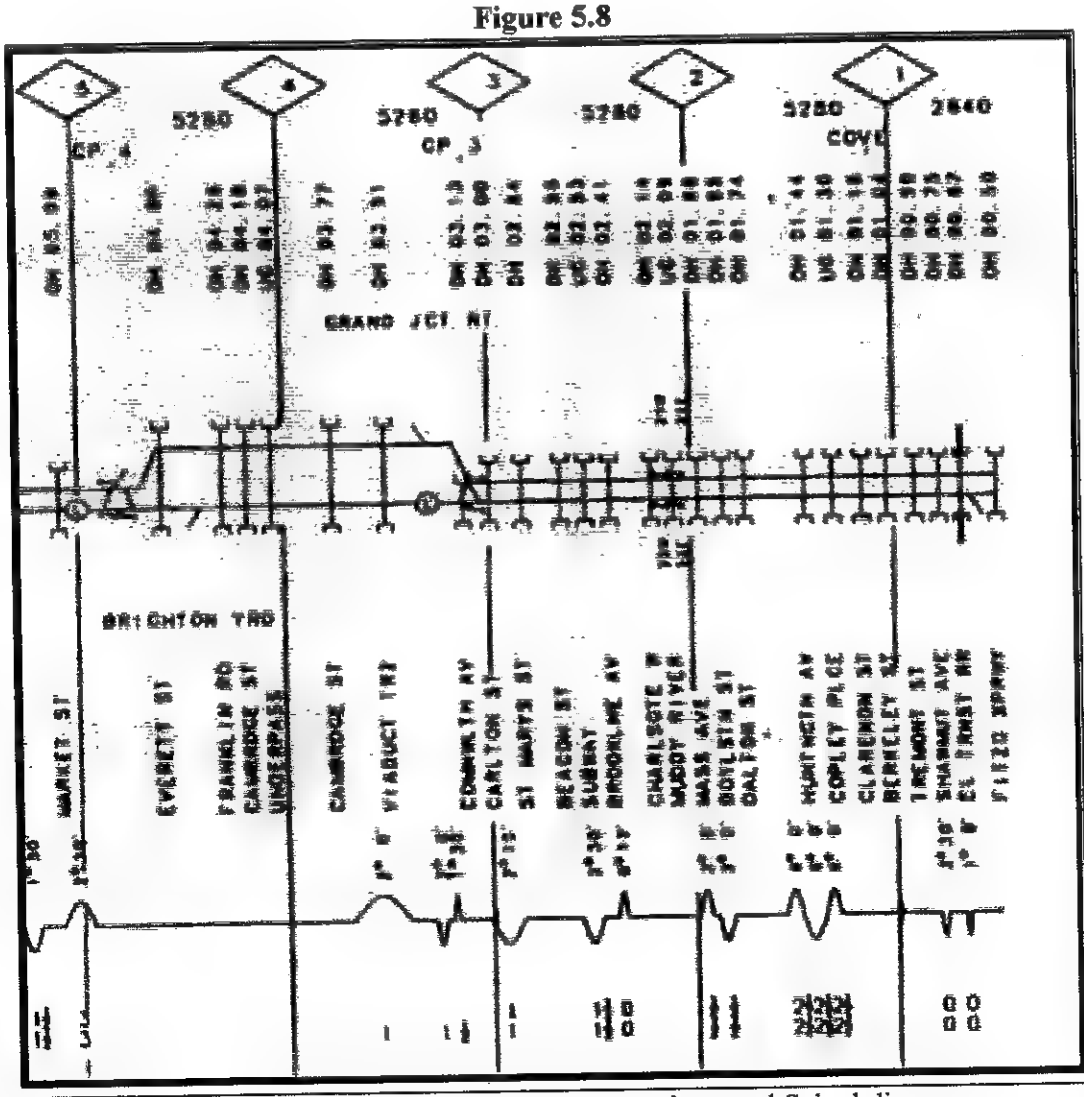
A diagram of the track layout is shown in Figure 5.8, which is an excerpt from the CSX track chart for the study area.

Between CP4 and CP3, the passenger railroad narrows to a single track. The other mainline track is reserved for freight operations only for the 1.8 miles of rail line adjacent to Beacon Park Yard. Passenger trains are not allowed to meet or pass between CP3 and CP4.

With this track configuration, trains serving the proposed new station on Track Two would need to be routed on that track for nearly four miles between Cove and CP4. Trains not serving the new station could use either track between Cove and CP3.

Over the trip segment where Fenway/Kenmore trains are routed on Track Two, they would need to serve both Fenway/Kenmore and Back Bay Stations on this track. The platform at Back Bay serving B&A Track Two could not be used by trains serving the proposed one track station since there is no crossover between Tracks One and Two between Brookline Avenue and Back Bay Station.

Figure 5.8



To evaluate how onerous these network configuration constraints would be for the operation of full-time service to the proposed new station, the study team conducted "string line" analyses of the anticipated 2010 timetable. The analysis determined where conflicts would prevent weekday trains from calling on the proposed new station. A string line analysis is a simple time distance plot to show the scheduled positions of trains on tracks over the schedule day. Train movements scheduled to meet between CP3 and CP4 are invalid due to freight restrictions. Only one of two trains passing between CP3 and Cove can be allowed to stop at the new station if it is only served by Track Two. The string line diagrams for the morning and afternoon peak periods are shown in Figures 5.9 and 5.10. Conflicts are highlighted with circles.

Figure 5.9
Morning Peak Schedule Analysis

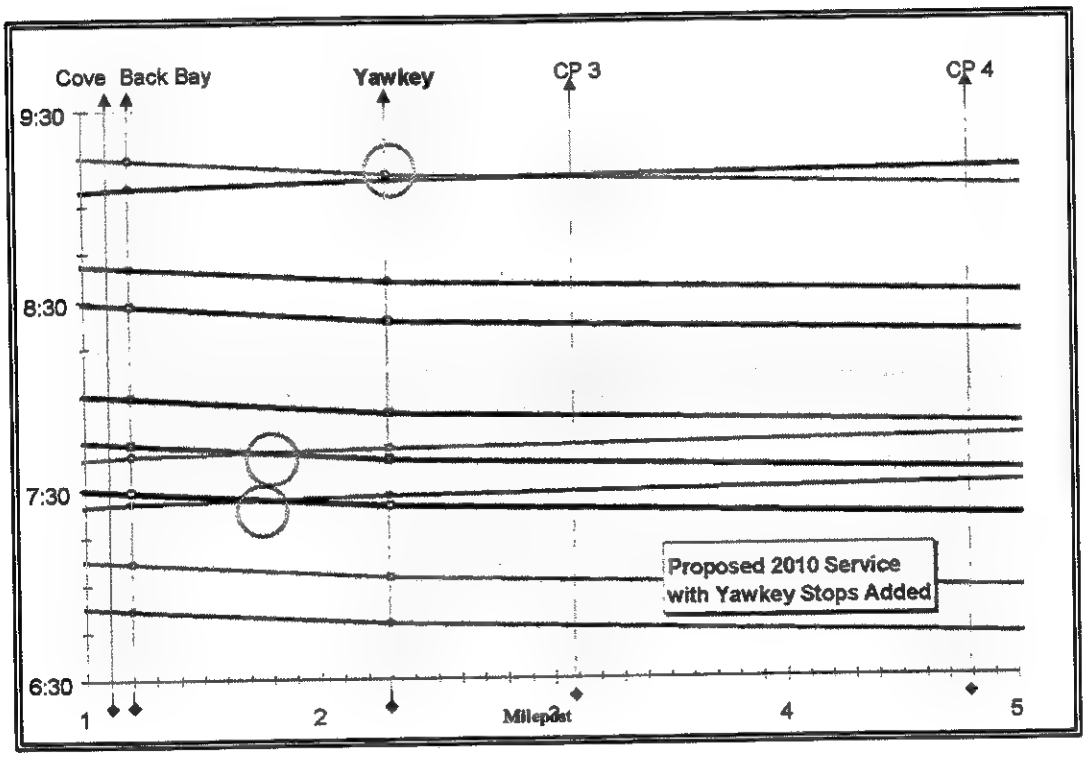


Figure 5.9 graphs the movement of trains between Cove and CP4 over the weekday peak period. Each color horizontal line represents a train trip. The direction of the train movement is indicated by the slope of the representational horizontal line. There are three outbound trains represented on the graph. Each conflict with an inbound peak train is marked with a circle.

Morning Peak -As shown in Figure 5.9, in the 2010 morning peak, it would not possible to allow any of the three outbound trains leaving South Station before 9:30 am to serve the proposed new single-track station since they would conflict with inbound trains.

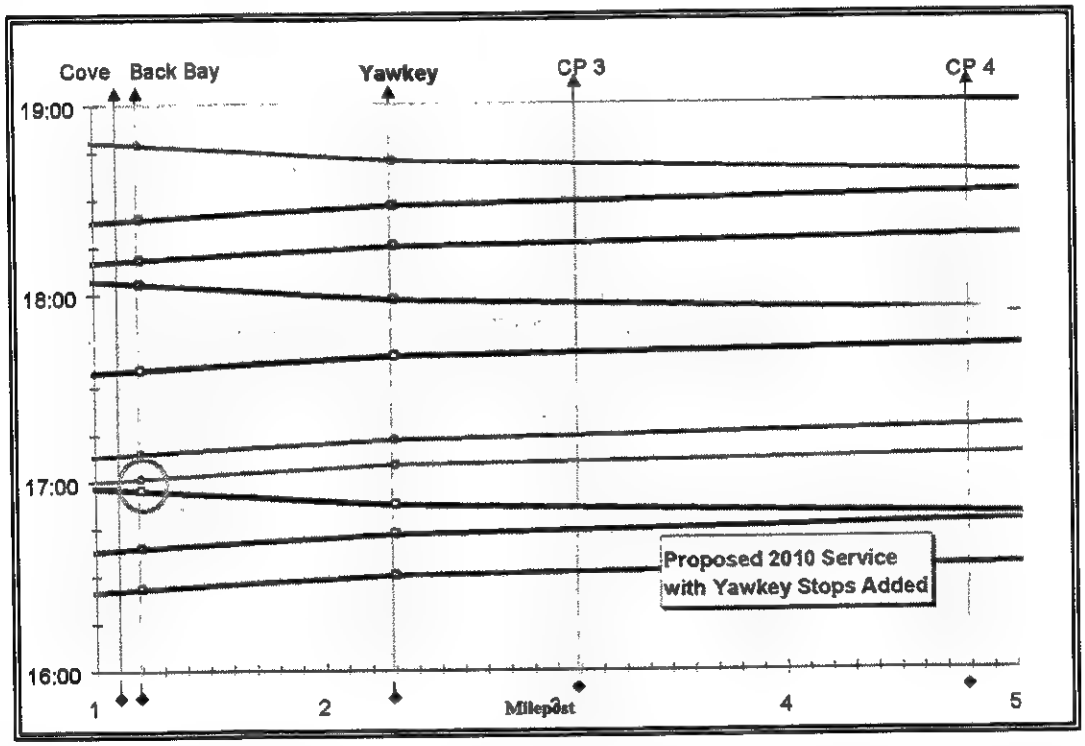
Afternoon Peak - As shown in Figure 5.10, during the afternoon peak, only one train poses a potential conflict at the proposed new station. The inbound train from Framingham roughly due

in Boston at 5:00 pm would conflict at Back Bay with the 4:55 pm express train to Worcester. This inbound 5:00 pm train could not be allowed to serve a single-track Yawkey Station.

During the off-peak period, all trains in both directions could call on the study area station without any conflicts.

A similar string line analysis was conducted using the 1999 schedule of trains. The results confirmed the analysis for the anticipated 2010 schedule. It was found that peak and off-peak trains could generally serve Yawkey Station, but that reverse peak trains would not be able to serve the proposed one-track station due to conflicts that occurred between Cove and CP4.

Figure 5.10
Reverse Peak Schedule Analysis



The string line analyses for both the anticipated 2010 weekday schedule and the current 2000 schedule of weekday trains indicate that a single-track station serving only Track Two appears feasible for peak and off-peak trains. With the present track configuration, it would not be possible to offer reverse peak service at a single platform station serving the study area.

Service Reliability and Flexibility - The insertion of a single-track station into the timetable will pose reliability risks for MBTA commuter service. Reliability would be compromised when trains are operating significantly off schedule. Off schedule operations are fairly common. National estimates indicate that 92% of all commuter rail trains arrive at their final destination within five minutes of their schedule – 96% arrive within nine minutes of schedule.

Consequently, scheduling to avoid conflicts caused by trains arriving late in Boston is obviously important. During off schedule operations, trains would need to be held in the westbound direction at Cove and in the eastbound direction at CP4 to allow both trains to serve the single-track station. Track improvements could be made to ameliorate this risk.

A new interlocking crossover could be installed in the vicinity of Milepost 2, between the proposed new station at Yawkey and Back Bay Stations. For the purposes of moving passenger trains, this new "CP2" could be a relatively simple "facing point crossover" would allow these trains to use the north platform at Back Bay Station. Similarly, the same facing point crossover could be used to allow trains calling on the north platform at Back Bay to also serve the proposed new station on B&A Track Two.

Discussions with CSX officials indicated that a high-level platform would probably not be acceptable on Track Two unless the MBTA provided a second crossover at CP2. The second crossover would allow eastbound freight trains to move between Track One and Track Two and allow westbound trains to move from Track Two to Track One. This crossover would allow freight trains to "run around" the high-level platform on Track Two.

The construction of two crossovers allowing full access between the two tracks by trains moving in either direction is called a "universal crossover". It is presumed that a universal crossover would be required if a high-level platform were constructed on Track Two.

3. High-Level Platforms

High-level platforms are favored at high-volume commuter rail stations because they can reduce the time spent waiting for passengers to board or alight. They also facilitate handicapped accessibility. A high-level platform would be especially desirable at the proposed new station to reduce the adverse travel velocity impacts that a new inner ring station on the line would impose on commuters from the west. A high-level platform is also desirable because time spent serving passengers at this single-track station could block the movements of off-schedule trains. The MBTA has also made a commitment to building high-level platforms to reduce architectural travel barriers to the handicapped populace. However, high-level platforms reduce the clearance envelope available for the movement of freight cars on the line.

Restricting the proposed new facility to a single-track station could help with the development of a high-level platform. With no platform on Track One, CSX would retain a full clearance route between Beacon Park Yard and South Boston via this line. Conversations between the MBTA and CSX regarding an expanded Yawkey Station indicate that CSX would not object to an expanded low platform at Yawkey Station. CSX indicated that with a universal crossover at a new CP2, it might be willing to consider a high-level platform on Track Two at the Yawkey Station site.

Recommendation

The eastern alternative is superior to the western alternative on site selection criteria. Subject to verification by physical field and detailed engineering surveys, the analyses indicate that a workable new station for full-time service could be constructed on Track Two between Beacon Street and Brookline Avenue. The full-time station would require a CP2 crossover to be built on the tangent track segment east of Brookline Avenue. The station platform would be 800 feet long. A high-level platform with a universal crossover would be necessary to minimize impacts on existing MBTA customers and services and meet CSX requirements.

Physical field surveys and detailed engineering analyses that were beyond the scope of this study may contradict the results of the informal inspections reported in this chapter. However, such findings will not be likely to significantly add to the cost or complexity of station engineering, construction or operation. It is also possible that a more detailed analysis may reduce the cost and complexity of building and operating the proposed station.

Over time, as projects develop around the proposed station site, the platform could be shifted westward under the Beacon Street Bridge. Several possible projects could cause portions of the recommended platform to be relocated westward. These projects include possible conflicts with the BU Science building, the possible need to create clearance for direct rail access to the abandoned Highland Branch for a shuttle service, and the development of an Urban Ring station at Saint Mary's Street. Under most of these future scenarios, much of the original platform could be preserved and the station platform merely extended westward. As air rights projects develop adjacent to Beacon Street, they may reconstruct the abutment that creates close clearance to the south of Track Two and allow a wider platform under the bridge. Under all future likely scenarios, the crossover improvements recommended for a new CP2 would be required and useable for a single-track station shifted westward.

CHAPTER 6
RIDERSHIP AND REVENUE

INTRODUCTION

This chapter of the report evaluates potential demand for and associated revenue from regular weekday service on the Worcester/Framingham line to the proposed new station. Four categories of ridership are evaluated:

- New trips from the west to the study area.
- Reductions in trips from the west to Back Bay and South Station resulting from increased travel time due to the proposed new station.
- New commuter rail trips from the study area to Back Bay and South Stations.
- Impacts on Green Line ridership.

Definitions

This chapter refers to boardings, alightings and trips.
The terms "boarding" and "alighting: refer to a one way passenger trip to or from a station.
Unless otherwise qualified, the term "trip" refers to a daily round trip to/from the study area.

The chapter is divided into four sections:

1. **Background:** provides a brief overview of forecasting methods and discusses travel times for the proposed new service, demographics, travel patterns, and recent trends in commuter rail ridership growth.

2. **Ridership Forecast**

   A. **New commuter rail trips from the west to the study area:** discusses methods used to project the number of current (1996) commuter rail trips that would be made if a new direct commuter rail service were to be offered and estimates forecasts for Year 2001 and 2010.

B. **Reduced commuter rail trips from the west to Back Bay & South Station:** details methods and findings of the forecast of reduced trips to Back Bay and South Station resulting from increased travel time due to the new station stop.

C. **New commuter rail trips from the study area to Back Bay and South Stations**: discusses methods and findings of the forecast of daily travel by commuter rail from the study area to Back Bay and South Stations.

D. **Summary of impacts on commuter rail ridership** synthesizes and summarizes the findings concerning new commuter rail trips to the study area, new commuter rail trips from the study area and impacts on existing ridership detailed in the preceding three sections.

E. **Impact on Green Line ridership** describes the methods and findings of the evaluation of potential impacts on Green Line ridership.

F. **Estimate of net new transit trips** estimates the volumes of daily travel that would be diverted by expanded direct commuter rail service from:
   - automobile to commuter rail,
   - rapid transit to commuter rail, and
   - commuter rail to automobile.

3. **Revenue impacts** presents an analysis of the potential impacts on MBTA revenue.

4. **Impact on study area traffic** presents a simple estimate of local roadway traffic impacts implied by the ridership projections.

1. BACKGROUND

Travel Times - As described in the previous chapter, commuter rail service to the proposed new station with a one-track configuration would be possible for all peak and off-peak trains. Reverse peak service to the proposed station without a second platform on Track One, however, would be problematic due to physical conflicts with the Massachusetts Turnpike on the north and potential concerns by CSX, the freight carrier serving the line. That is, outbound service from the new station in the morning peak and inbound service during the afternoon peak would not be feasible.

For ridership and revenue forecasting, KKO assumed that the 2010 schedule of service to the proposed new station shown in Appendix A would be operated. Under this schedule, 38 trains per day would serve the proposed new station. Commuter rail travel times from the proposed station to Boston would be five to ten minutes.

Table 6.1

Typical Travel Times (Minutes)	
	Fenway/Kenmore Station
Back Bay Station	5
South Station	10

For riders who both live and work near these rail stations, the in-vehicle travel times compare favorably with those for existing transit options.

- The 10-minute commuter rail trip from the proposed new station to South Station would be 50% faster than the 15-minute peak ride using a combination of Green and Red Lines from Kenmore Station.

- The 5-minute commuter rail trip from the proposed new station to Back Bay would be comparable to the five-minute peak ride using the Green Line from Kenmore Station to Copley Station.

However, for most riders with work destinations other than the immediate vicinities of South Station or Back Bay Station, the travel time advantage of commuter rail over current rapid transit service would be less. The range of stations and transfer opportunities available for rapid transit customers is greater than it would be for a limited commuter rail service. Service frequencies for the rapid transit lines are much higher than for commuter rail. On the other hand, crowding and passenger comfort on commuter rail is much less of a problem in comparison with peak period rapid transit services.

KKO also determined that with the introduction of a new stop at the proposed new station, the average travel times between Boston and suburban stations west of the proposed new station increased by two or three minutes depending upon the station.

The schedule and travel time information from the previous chapter became input data for ridership forecasts.

Review of Demographics and Travel Patterns - As described in earlier chapters, the study area currently harbors approximately 43,000 employees and approximately 28,000 inhabitants. Of the 43,000 employees, it is estimated that about 4,000 live in areas readily accessible to suburban stations on the Worcester/Framingham line. Information on current and future demographics and travel patterns were used to develop the ridership forecasts presented in this chapter.

No specific information on travel from the study area by local residents was developed because this is not expected to constitute a substantial travel market for the proposed service.

Trends in Ridership Demand:

Potential for Ridership Terminating in the Study Area – Using the proposed new station for weekday service on the Worcester/Framingham line would create a new destination station in the downtown district that would be served by approximately 38 daily trains. The station would be approximately 1.2 miles from Back Bay Station and would have no direct connections to rapid transit lines. The proposed new station would be the only inner-ring destination station that does not offer a direct connection to a rapid transit line.

Currently, the MBTA Commuter Rail network has three principal downtown stations, each of which has transfer points to rapid transit lines. 82% of all passenger trips on the commuter rail network are estimated to start or end at one of these three terminals.[1]

Table 6.2

MBTA Commuter Rail Terminal Stations

Station	Lines	1999 Daily Trains[2]	1993 Daily Boardings[3]	Rapid Transit Connections
South Station	Seven	281	12,307	Red Line
North Station	Five	182	12,283	Orange Line and Green Line
Back Bay	Five	162	7,622	Orange Line

In addition, the MBTA commuter rail network has five other stations that are heavily used as commuter destinations. These five stations are also transfer points between commuter rail and the rapid transit lines.

Table 6.3

Other MBTA Inner Ring Stations

Station	Lines	Daily Trains	Daily Inbound Alightings[3]	Rapid Transit Connections
Porter Square	Fitchburg	32	832	Red Line
Forest Hills	Needham	31	7	Orange Line
Ruggles	Providence	16	473	Orange Line
Malden	Haverhill	41	734	Orange Line
Braintree	Old Colony	30	N/A	Red Line

[1] CTPS 1993 Commuter Rail Passenger Survey
[2] 1999 Schedule of Trains
[3] CTPS 1993 Commuter Rail Passenger Survey, does not include extension to Worcester on the Framingham Line, Old Colony and Kingston Lines, or the Newburyport extension on the Ipswich Line.

Despite the fact that the proposed new station would not have a direct connection to a rapid transit line, the station does appear to have some potential for development as a destination station since the study area contains a significant concentration of employment. A substantial fraction (9% in 1990) of persons holding jobs in the study area live in the Worcester/ Framingham corridor. Development projections based on CTPS forecasts for the next 20 years indicate that white-collar employment in the area will further increase by 38% to 37,659. In light of these statistics, the proposed new station may have significant potential as a destination for terminating commuter rail trips.

2. RIDERSHIP FORECAST

Potential for Ridership Originating in the Study Area - In all North American commuter rail systems, the ridership from inner ring, urban commuter rail stations is typically modest. In Boston, this trend is especially pronounced. Stations outside a 7.5-mile ring around the city generate most of the ridership. The following table shows the daily boardings at all MBTA commuter rail stations located within 7.5 miles of the downtown terminal.

Table 6.4

1999 Daily Inbound Boardings at Inner Ring Rail Stations by Milepost

Station	Line	Milepost	1999 Boardings
Yawkey Station	**Worcester**	2.3	
Ruggles	Providence/Attleboro	2.3	20
Uphams Corner	Dorchester Branch	2.4	104
Porter Square[4]	Fitchburg	4.0	154
Malden Center	Haverhill	5.1	34
Chelsea	Rockport/Ipswich	5.2	222
Morton Street	Dorchester Branch	5.2	208
Forest Hills	Needham Branch	5.4	143
West Medford	Lowell	6.1	380
Wyoming Hill	Haverhill	6.8	226
Roslindale Village	Needham Branch	6.8	592
Belmont	Fitchburg	7.0	152
Melrose/Cedar Park	Haverhill	7.3	270

Source: MBTA Ridership Reports February 11, 1999

Commuter rail ridership in Boston and in other cities is much stronger from locations further outside the city. As shown in the following table, boardings at stations within 7.5 miles of the city average about one third of the boardings at more distant stations.

[4] Porter Square station is also served by the Red Line. Malden Center and Forest Hills stations are also served by the Orange Line.

Table 6.5

1996 Daily Inbound Boardings by Distance from Boston							
	Less than 7.5 Miles	7.5 to 12.4 Miles	12.5 to 17.4 Miles	17.5 to 22.4 Miles	22.5 to 29.9 Miles	30 to 50 Miles	Total
Average Daily Boardings	128	485	567	523	678	512	N/A

Source: 1996 MBTA Ridership Statistics

The current low level of commuter rail ridership at close-in stations observed in Boston and elsewhere in the United States is due to a variety of circumstances including:

- **More transit service options** – potential commuter rail passengers from close-in communities usually have alternate public transit options that serve more destinations at higher frequencies and lower fares than commuter rail.

- **Slower service** – commuter rail trains from close-in stations tend to operate at slower overall speeds than trains from more distant stations because the trains slow down when passing through the complex plant of interlockings as the lines converge on the downtown terminal.

- **Wait times** – commuter rail operates relatively infrequently as compared to other transit modes. Fewer potential passengers are willing to use an infrequent service for relatively short trips.

Methods - Three different forecasting methods were used to predict likely ridership outcomes from the institution of full weekday service to the proposed new station. Five ridership impacts were evaluated, and a summary section for the impact on full-time commuter rail service to the proposed new station was included.

A. **New commuter rail trips from the west to the study area** - Potential for commuters from the west to be diverted from automobiles. This market was evaluated using the 1996 TRCP H-1 commuter rail model.

B. **Reduced commuter rail trips from the west to Back Bay and South Station** – Potential reductions in commuter trips diverted to automobiles as a result of increases in travel time due to serving the proposed new station. This impact was evaluated using a KKO model developed for Boston commuter rail service planning.

C. **New commuter rail trips from the study area to Back Bay and South Station** - Potential use of commuter rail by study area residents travelling to downtown Boston. This small market was evaluated using the KKO model.

D. **Summary of impacts on commuter rail ridership** – A synthesis of the preceding three impacts.

E. Impacts on Green Line ridership – Reduced light rail ridership due to new direct competing service from commuter rail. Impacts on Green Line ridership were evaluated through residual analysis and evaluation of the 1990 US Census and 1996 CTPS travel data.

F. Estimate of net new transit trips

A. Forecast of New Commuter Rail Trips from the West to the Study Area. - This section describes the model used to predict potential ridership to the new station from western stops on the Worcester/Framingham line.

First, a brief description of the study area is given with a graphical depiction of the physical study area boundaries. The model is then described, and results are presented.

Because the demographic data that are inputs to the forecasts are 1990's estimates, the initial projections were made as if the service were to be offered in the 1996 commuter travel market. These 1996 estimates were then escalated to the years 2001 and 2010

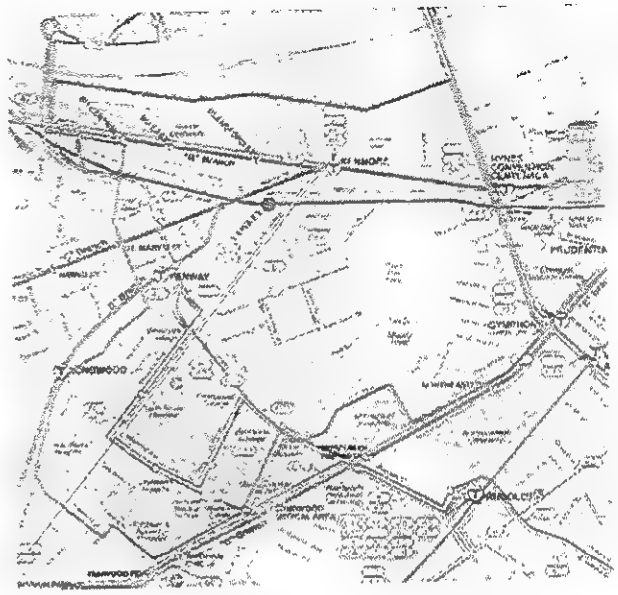


Figure 6.1: Aerial view of study area (outlined in red)

Study Area Definition and Characteristics – The study area is based on zones established by the Central Transportation Planning Staff. The CTPS zones included in the study area are zones 87, 88, 90 through 92, and 94 through 98. These zones represent the range of adjacent and nearby traffic analysis zones that are the most likely destinations for commuters from the western suburbs. No point in the study area is more than one mile from the proposed new station. One mile has been established as a reasonable upper bound on the distance commuter rail patrons will walk after alighting from the train at the work end of the trip. Despite commuter rail patrons' general willingness to walk to their downtown destinations, it was assumed that MASCO would provide shuttle bus service to all study area work sites south of Park Drive.

The Generalized Direct Transit Demand Estimation Model - As noted above, the project team used a model developed for the United States DOT Transit Cooperative Research Program (TCRP) to predict the number of daily commuter rail passenger trips that would be made from the Worcester/Framingham corridor to the study area. The TCRP model was developed using data from six U.S. cities with large commuter rail systems, including Boston. This linear regression model estimates the number of total daily boardings at each station along each line based on the following variables:

1. If there is parking available at the origin station
2. If there is a feeder bus providing service to the origin station
3. Average household income at the origin station
4. Residential density at the origin station
5. Miles from the origin station to the terminal station
6. Employment density in the terminal station

The first two variables are binary – they are equal to 1 if there is parking available at the station or if there is a feeder bus, and zero otherwise. Because there is no feeder bus service for any of the stations west of the study area, the second variable was eliminated from the analysis. Additionally, although parking exists at many of the commuter rail stations, most, if not all, of it has already been taken by existing riders on the system. Consequently, for the purpose of the model, the team considered there to be no parking available at the stations and this variable was also eliminated from the analysis.

The next three variables are characteristics of each individual station. Variables 3 and 4 are socio-economic characteristics of the population surrounding the commuter rail station. The data for this part of the model was taken from the 1990 Census data by specifying a 2-mile band around each station, as detailed in the model design. Variable 5 is simply the distance from each station to the terminal station.

The last variable in the model is the employment density in vicinity of the destination terminal station. For the purposes of this analysis, the study area of .84 square miles with 43,000 employees was considered as the terminal station area.

Table 6.6 shows the coefficients and variable forms included in the forecasting model equation.

Table 6.6

TCRP H-1 Commuter Rail Demand Estimation Model[5]

Service Characteristic	Linear Transformation	Coefficient
If parking present at Origin Station	None	1.173
If feeder bus at Origin Station	None	0.499
Average household income at Origin Station	Log of household income	0.877
Residential density at Origin Station	Log of population density	0.249
Miles to Terminal Station (1)	Log of miles to Terminal	0.852
Miles to Terminal Station (2)	Miles to Terminal * Log of miles to Terminal	- 0.0054
Employment density at Destination Station	Log of terminal area employees per acre	0.715

[5] Source: TCRP Report 16: Transit and Urban Form, Volume 1, Part II, pp. 8–55.

Forecast Results - CTPS estimates that the employment density in the study area is approximately 80 employees per acre. Based on this density, and US census data on the corridor population, the model projects that 966 people, primarily residents who work in the study area, would board the commuter rail trains daily at stations along the Worcester line to travel to destinations in the study area.

Table 6.7

Model Projections of Daily Boardings		
Station	**Miles to Study Area Station**	**Predicted Total Daily Boardings**
Worcester	41.8	**85**
North Grafton	36.5	**49**
Westborough	33.9	**55**
Southborough	27.5	**70**
Ashland	24.9	**58**
Framingham	18.9	**70**
West Natick	17.4	**69**
Natick	15.2	**62**
Wellesley Square	12.2	**81**
Wellesley Hills	11	**104**
Wellesley Farms	10	**86**
Auburndale	7.7	**63**
West Newton	6.6	**62**
Newtonville	5.6	**53**
TOTAL		**966**

Comparison with other MBTA Stations - Forecasted alightings for the proposed new station are somewhat consistent with alightings at other close-in stations in the MBTA system. Of the eight stations that are within six miles of Boston, the proposed new station would rank first in terms of weekday alightings.

Table 6.8

Inbound Alightings at MBTA Commuter Rail Stations within 6 Miles of Boston				
Station Rank	**Station Name**	**Line**	**Miles to Boston**	**Weekday Alightings**
1	**Yawkey**	**Worcester**	2.5	966
2	Porter Square	Fitchburg	4.0	832
3	Malden Center	Haverhill	5.1	734
4	Ruggles	Attleboro	2.2	473
5	Chelsea	Rockport	5.2	12
6	Forest Hills	Needham	5.4	7
7	Morton Street	Dorchester	5.2	0
8	Uphams Corner	Dorchester	2.4	0

Source: CTPS 1993 Commuter Rail Passenger Survey

Adjusting the Forecast - Not every traveler in the 966 daily trip forecast would be new to the commuter rail network. Some persons are already using commuter rail to travel to the study area from the Worcester/ Framingham corridor, but at this time they are travelling to Back Bay Station and then travelling west on the Orange Line or Green Line back to the study area.

The 1990 Census and the 1993 CTPS Commuter Rail Ridership Survey assessed the number of commuters living along the Worcester Line that already use commuter rail to reach destinations in the study area. According to the US Census, 144 persons from the corridor used commuter rail to reach jobs in the study area. According to the Commuter Rail Ridership Survey, the total railroad commuters from the study area totalled 173.

Since the early 1990's, ridership on this Worcester/Framingham line has increased substantially. For instance, in 1992, the typical total daily inbound boardings were 3,783. By 1997, it had increased nearly 75% to 6,545. Based on this general growth in commuter rail ridership in this corridor, it would seem reasonable that 1996 ridership from the corridor to the study area had grown to approximately 256 daily inbound boardings. The 256 individuals who are currently using commuter rail to reach jobs in the study area cannot be considered new system riders and should be subtracted from the estimates presented above. This yields a mid-1990's projection of ridership to the study area of 710 new daily inbound commuter rail boardings.

Forecasting future growth in ridership - Forecasts of new riders based in 1996 must be updated to reflect current and future conditions. To forecast how the ridership to the proposed new station would grow over the next ten years, the study team used a combination of actual observed information on growth and CTPS forecasts of MBTA commuter rail systemwide growth to escalate the 1996 projections.

It was determined that the net ridership to the study area from locations to the west measured by daily inbound boardings would be 710 boardings for 1996, 799 for the year 2001 and a projected 987 for the year 2010.

Table 6.9

Summary of Findings: Estimated Net Ridership to Study Area from the Western Suburbs	
Year	**Daily Inbound Boardings**
1996	710
2001	799
2010	987

B. Forecast of Reduced Commuter Rail Trips from the West to Back Bay & South Station
Adding the proposed new station into the schedule of trains operating between South Station and Worcester/Framingham will add travel time to each trip with deceleration, stopping, passenger service and acceleration away from the new station. This section describes the forecast methods and findings concerning the impacts on western originated ridership to South Station and Back Bay. A brief description of the model used to project the impact on South Station/Back Bay ridership is provided, followed by presentation of the results.

KKO Boston Commuter Rail Boardings Model - To facilitate a commuter rail route evaluation and service improvement project conducted for the MBTA in 1995-96, KKO prepared a commuter rail demand projection model to predict boardings at commuter rail stations. The model was developed using 1995 and 1996 MBTA boardings data and simple "least squares" multiple regression techniques. The projection model predicts station boardings as a function of level of service and station location. The model can be used to estimate the change in boardings at any station in response to a change in service or it can be used to forecast the ridership that would be expected from a new station.

The 1996 model indicates that ridership is very sensitive to frequency and travel speed. For example, the average effect of increasing the speed between a station and downtown by one mile per hour is equivalent to adding thirteen parking spaces at the same station. A reduction of one mile per hour in peak service velocity to downtown reduces the forecast ridership by 13.5 daily inbound boardings.

Table 6.10

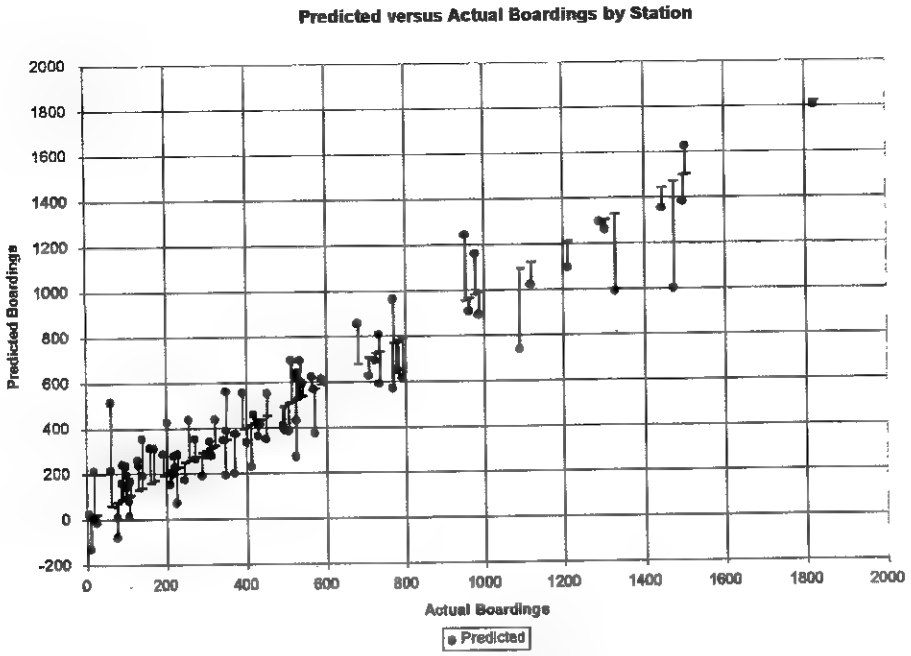
1996 Boston Commuter Rail Boardings Model[6]

Service Characteristic	Coefficient
Average MPH to Boston	13.5
Parking Spaces at Station	1.0
Number of Weekday Trains	13.0
Less than 10 miles from Boston	-179.6
Y Intercept	-543.8

The model does a reasonable job of predicting boardings as a function of level of service. The following figure shows the predicted and actual values for each of the stations in the estimation data set.

[6] Control Factors: Y Intercept = -543.8, South/North Dummy = 206.0, R - Squared = .87, Degrees of Freedom = 88, SSE=149. Non-origin and selected inner band stations excluded from estimation data set.

Figure 6.2
Predictive Accuracy of Boston Commuter Rail Boardings Model



The addition of a new station between Boston and the 14 stations that currently operate (or are under construction) west of the study area would degrade service to those stations by slowing service to downtown Boston. Passengers from a western station would experience longer travel times and slower service speeds. Forecast impacts on travel time and service velocity from outer stations were discussed in Chapter 5 and summarized below.

These schedule estimates were used with the Boston Commuter Rail Boardings Model to predict the impact on existing ridership.

Table 6.11

Forecast Impacts of New Study Area Service On Peak Travel Times, Speeds and Ridership To Other Boston Destinations

STATION	Mile Post	Travel Time With New Station	Base Case Travel Time	Change in Speed	Forecast Change in Inbound Boardings
Worcester	44.2	1:19	1:17	-0.9	-12.1
Grafton	36.5	1:05	1:03	-0.9	-12.7
Westborough	33.9	1:00	0:58	-1.0	-13.9
Southborough	27.1	0:51	0:49	-1.2	-15.6
Ashland	24.5	0:46	0:44	-1.3	-17.4
Framingham	21.4	0:45	0:42	-1.3	-17.5
West Natick	19.9	0:45	0:42	-1.2	-16.1
Natick	17.7	0:40	0:38	-1.3	-17.9
Wellesley Square	14.7	0:35	0:32	-1.5	-19.7

Forecast Impacts of New Study Area Service On Peak Travel Times, Speeds and Ridership To Other Boston Destinations					
STATION	Mile Post	Travel Time With New Station	Base Case Travel Time	Change in Speed	Forecast Change in Inbound Boardings
Wellesley Hills	13.5	0:31	0:29	-1.6	-22.1
Wellesley Farms	12.5	0:28	0:26	-1.9	-25.1
Auburndale	10.2	0:24	0:22	-2.5	-33.4
West Newton	9.1	0:22	0:19	-2.8	-38.2
Newtonville	8.1	0:19	0:16	-3.4	-45.9
Yawkey Station	2.3	0:10	NA	NA	0.0
Back Bay	1.2	0:05	0:05	0.0	0.0
South Station	0.0	0:00	0:00	NA	0.0
Total					**-308**

Based on the model results, the impact on 1996 ridership would be approximately 308 fewer daily inbound boardings to Back Bay and South Station due to increased peak travel times of two to three minutes from each of the western suburban stations on the line.

Extrapolated, the daily inbound boardings to Back Bay and South Station would experience a reduction that would result in 308, 346 and 428 fewer boardings for the years 1996, 2001 and 2010 respectively.

Table 6.12

Summary of Findings: Estimated Impact on Ridership to other Boston Destinations from the Western Suburbs	
Year	**Change in Daily Inbound Boardings**
1996	-308
2001	-346
2010	-428

C. Forecast of New Commuter Rail Trips from Study Area to Back Bay and South Stations - This section discusses potential ridership by study area residents to South Station and Back Bay. The KKO Boston Commuter Rail Boardings model described above was used to predict this ridership impact.

Because of the proximity of the proposed new station to central Boston, it is not expected that many commuters will ride the commuter rail from the study area to downtown Boston. This expectation is supported by the existence of fairly extensive bus and subway/lightrail service in the area. A total of 12 local bus routes and two branches of the Green line serve the study area.

KKO's Boston Commuter Rail Boardings Model was used to predict the ridership that would be expected from the proposed new station to the east if the station were opened for weekday service. Application of the model for the study area is summarized in Table 6.13 below. It predicts that some study area residents will use the new 38-train service to reach downtown Boston, and that this number would total approximately 162 daily riders.

Table 6.13

Estimating 1996 Daily Inbound Boarding From Proposed New Station to Downtown Boston:
Using Boston Commuter Rail Boardings Model

Service Characteristic	Coefficient	Value	Result
Parking Spaces at Station	1.0	0	0
Number of Weekday Trains	13.0	38	494
Average MPH to Boston	13.5	13.7	185
Less than 10 miles from Boston	-179.6	1	-180
North South Dummy	206.0	1	206
Y Intercept	-543.8	1	-544
Total			**162**[7]

The forecast of 162 daily inbound boardings from the study area to the downtown terminals is relatively high for an inner-ring commuter rail station. However, this forecast is deemed credible due to several circumstances including:

1. The density of service that would be offered with 38 trains per day.
2. The density of residential development near the proposed new station.
3. The 50% travel time advantages to South Station that the commuter rail service would offer relative to Green Line service from Kenmore Square.

Estimated daily inbound commuter rail boardings from the study area to the downtown terminals would be 162 for the year 1996, 166 for the year 2001 and an estimated 176 for the year 2010.

Table 6.14

Summary of Findings:
Estimated Daily Inbound Commuter Rail Boardings From the Study Area to Downtown Boston

Year	Daily Railroad Boardings to Boston
1996	162
2001	166
2010	176

[7] Includes rounding error.

D. Summary of Impacts on Commuter Rail Ridership

The three forecasts presented above focus on three direct commuter rail ridership impacts that would be expected if full-time weekday service on the Worcester Line were offered to the proposed new station. The forecasts are summarized in Table 6.15.

Table 6.15

Summary of Forecasts:
Daily Commuter Rail Ridership Impacts

Forecast Year	1996	2001	2010
Total Trips to Study Area from Western Suburbs	966	1,087	1,343
New Boardings from Study Area to Boston	162	166	176
Total Persons Using New Station	**1,128**	**1,253**	**1,519**
Current trips made on commuter rail	-256	-288	-356
Loss of boardings to other Boston destinations from the West due to increased travel time	-308	-346	-428
Total Net Trips	**564**	**619**	**735**

Focusing on the year 2001 estimates, total commuter rail ridership to the study area would be approximately 1,087 daily people many of whom would require shuttle bus service to jobs in the Longwood Medical Area[8]. Approximately 288 of these passengers would be current commuter rail riders who would otherwise use rapid transit service from Back Bay to reach the study area. The balance would be new railroad riders diverted from other modes.

It is estimated that 346 current riders on the commuter rail line to Back Bay and South Station would stop using commuter rail and divert to another mode due to increased travel time to downtown. This would entail a reduction in ridership to downtown Boston of approximately 3% on the Worcester/Framingham line.

In the year 2001, approximately 166 local study area residents would use the new service each day to reach Back Bay and South Stations.

The net ridership impact of all these changes in the year 2001 would be to increase total commuter rail ridership by 619 daily inbound boardings. This would represent an overall increase in ridership on the line of approximately 6%. Approximately 1,238 new daily commuter rail trips[9], reflecting inbound and outbound travel, would be made on the line in the year 2001.

[8] Longwood Medical Area has made a commitment to serve the commuters on the trains with a bus to the hospital district.

[9] (619 * 2)

E. Impact on Green Line Ridership

The MBTA's Green Line provides extensive service to the study area. This portion of the report discusses the likely effect weekday commuter rail service to the study area would have on the demand for Green Line services. Three categories of impact are considered:

1. Eastbound trips from the study area as commuter rail service substitutes for Green Line service.

2. Westbound trips to the study area by current commuter rail passengers using Green Line service between Copley and the study area.

3. Eastbound trips to the study area from the western terminals of the Green Line as suburban commuters substitute commuter rail service from the Green Line for commuting to the study area.

Each of these impacts is discussed separately.

Eastbound trips from the study area as commuter rail service substitutes for Green Line service. It is estimated that, in the year 2001, approximately 166 daily trips from the study area would be made to South Station and Back Bay from the study area. In the absence of the proposed new service, it is very likely that all these trips would be made on the Green line, as residents of the Fenway/Kenmore area generate this traffic.

Westbound trips to study area by current commuter rail passengers using Green Line service between Copley and the study area. In the absence of full-time service to the proposed new station, it is estimated that in the year 2001 approximately 288 daily trips using a combination of the Worcester/Framingham Line and the Green Line will be made to the study area. With the opening of the proposed new service, it could be expected that these 288 daily westbound trips on the Green Line would be made superfluous by the direct service to the Fenway/Kenmore area from the west.

Eastbound trips to the study area from the western terminals of the Green Line as suburban commuters substitute commuter rail service for the Green Line. As presented in Chapter 3, only a very small number of Worcester/ Framingham commuters to the study area use Green Line rail transit service for commuting. According to the 1990 Census, only 33 commuters from communities west of Newton used the Green Line to commute to the study area. From Newton, the daily 1990 Green Line commuter total was 162 daily trips. With an assumed growth from 1990 to 2001 of 75% (roughly based on commuter rail ridership growth figures), these two census estimates would grow to roughly 58 and 284 daily inbound trips respectively.

With the opening of weekday service to the Fenway/Kenmore area it is likely that 75% of the current Green Line trips to the study area made by residents of Framingham, Natick, and other western suburbs would be diverted to commuter rail. Among the commuters from Newton, it would be optimistic to expect that as many as 25% would divert from the frequent Green Line service to the new commuter rail service. Consequently, a plausible year 2001 estimate of the

total reduction in Green Line commuter trips from the west to the study area would be approximately 114 daily inbound trips (combination of trips from western suburbs and Newton/Riverside Station).

Table 6.16

Summary of Forecasts: Daily Green Line Impacts		
Forecast Year	**2001**	**2010**
Eastbound trips toward downtown Boston.	-166	-176
Westbound trips from commuter rail terminals	-288	-356
Eastbound trips by commuters from western suburbs	-43	-51
Eastbound trips by commuters from Newton	-71	-84
Total Net Trips	**-568**	**-667**

This reduction in ridership represents a small fraction of total Green Line trips terminating in the study area. It was reported in Chapter 3 that more that 16,000 daily Green Line trips terminate in the study area. A reduction of 568 trips would reduce Green Line use at these stations by approximately 3%. Systemwide, the new commuter rail service would reduce the total Green Line ridership of more than 200,000 daily boardings by only 0.5%

F. Estimate of Net New Transit Trips

This portion of the report briefly evaluates the implications of the ridership forecasts in light of the anticipated impact on overall transit use and diversion of trips from private automobiles. It is forecasted that in the year 2001, a total of 1,253 commuters will use the proposed new station for their morning commute. However, only a fraction of these commuters will be new transit riders.

Table 6.17

Analysis of Net New Transit Ridership from Proposed New Service to Fenway/Kenmore Area (Year 2001)		
Commuter rail passengers by former mode of travel	**Totals**	**Percent of Total**
Total commuter rail trips to study area each morning	1,253	100%
Automobile commuters diverted to proposed new service for commuting to study area	685	55%
Commuter Rail/Green Line/Orange Line trips diverted to proposed new service from Back Bay	-288	23%
Green Line Riders from the west diverted to commuter rail at proposed new station	-114	9%
Green Line riders diverted to commuter rail for trips to downtown Boston	-166	13%
Net New Transit Commuters to Study Area	**685**	**55%**
Additional ridership impacts outside study area		
Commuter rail riders to downtown diverted to automobile due to increased travel times on commuter rail	-346	28%
Net New Transit Riders Systemwide	**339**	**27%**

New Transit Trips to the Study Area - It is anticipated that the 1,253 persons forecasted to use the proposed new station each day would include 685 persons who would have formerly been commuting to the study area by automobile. The balance of 568 would be travelers who formerly used the Green Line, or a combination of commuter rail and rapid transit services, for commuting. Of these 568 commuters, 288 would be persons who had used a commuter rail in conjunction with rapid transit service to reach the study area. 114 would be persons who had used MBTA D-Line services to commute to the study area. 166 would be persons who had been travelling from the study area to the vicinity of South Station via the Green Line and Red Line and would now use the commuter rail to make the same trip more directly. Thus, relative to the study area, it is expected that 55% of the trips would be new transit trips to and from the study area. The balance would be trips that would be diverted from the Green Line or a combination of the Green Line and Commuter Rail.

New Transit Trips Systemwide - From a broader systemwide perspective, full-time service to the study area would detract from the attractiveness of commuter rail to travellers from west of the Fenway/Kenmore area to Back Bay and South Station. Adding two or three minutes to every peak period trip on the line would likely reduce demand for service to Back Bay and South Station by 346 passengers per day. This reduces the net gain in transit ridership to 339 new transit passengers each day. On net, only 27% of the total daily traffic at the proposed new station each morning would be expected to represent new riders to the transit network.

3. Revenue Impacts

This section of the chapter considers the MBTA passenger revenue impacts that would occur should full service be offered to Fenway/Kenmore area. The analysis focuses on fare revenue. It does not consider parking revenues or other non-fare sources of funds.

The analysis was conducted in two parts using forecasts for a 1996 base year. One part focused on changes in commuter rail revenue that would result from the proposed new service. This included:

1. Increases in revenue due to travellers diverted from automobiles.
2. Decreases in revenue due to reductions in commuter rail use to Back Bay and South Station.
3. New commuter rail travel from the study area to downtown.
4. Existing riders who would now use the proposed new station rather than Back Bay Station.

The second part focused on reduced Green Line revenue due to diversion of trips to commuter rail.

Commuter Rail - The commuter rail forecast is detailed in Table 6.18.

Table 6.18

Proposed Fenway/Kenmore Station: 1996 Base Year Commuter Rail Revenue Forecasts						
Station	**Fare Zone**	**Average Revenue per Passenger**	**Predicted Change in Daily Boardings to New Station**	**Predicted Change in Daily Boardings to South Station due to New Station**	**Net Change in Boardings**	**Net Change in Two Way Revenue**
Worcester	9	$3.56	85	-12	73	$519
North Grafton	8	$3.16	49	-13	36	$229
Westborough	8	$3.16	55	-14	41	$260
Southborough	6	$2.71	70	-16	54	$295
Ashland	6	$2.71	58	-17	41	$220
Framingham	5	$2.58	70	-18	53	$271
West Natick	4	$2.27	69	-16	53	$240
Natick	4	$2.27	62	-18	44	$200
Wellesley Square	3	$1.96	81	-20	61	$240
Wellesley Hills	3	$1.96	104	-22	82	$321
Wellesley Farms	3	$1.96	86	-25	61	$239
Auburndale	2	$1.73	63	-33	30	$102
West Newton	2	$1.73	62	-38	24	$82
Newtonville	1	$1.52	53	-46	7	$22
Gross Total			967	-308	659	$3,241
Adjust for 256 current commuter rail users			710	-308	402	$2,380
New Station	1A	$0.70	162	0	162	$227
Commuter Rail Totals			**872**	**-308**	**564**	**$2,606**

The ridership forecasts are restatements of figures presented in Table 6.11 and Table 6.15. MBTA Commuter Rail and Operations Planning provided the one-way fare and revenue per passenger data. Based on these estimates, it is anticipated that weekday commuter rail revenue resulting from service to the study area would equal $2,606. This would include:

- 710 passengers from the west travelling to the study area,
- 308 passengers for downtown diverted from commuter rail to automobile,
- 256 study area commuter rail passengers who are already using commuter rail via Back Bay and
- 162 new daily passengers anticipated from the study area to downtown.

Green Line Providing direct commuter rail service to the Fenway/Kenmore area will tend to somewhat reduce Green Line usage. There are three categories of impact on Green Line ridership and revenue:

1. Local eastbound riders diverted from Green Line to Commuter Rail.
2. Commuter rail riders using Green Line from Back Bay to study area.
3. Green Line passengers from the west diverted to the new commuter rail service.

MBTA Operations Planning provided the revenue per passenger estimate of $0.70 per boarding. The passenger forecasts are the estimates for 1996 presented earlier in this chapter. The daily change in revenue from the Green Line would equal an average reduction of $359 per day. This includes 162 daily riders who would stop using rapid transit for travel to locations near South Station and use the proposed new commuter rail service instead. It also includes an estimated 95 passengers from the west that would stop using the Green Line and begin using commuter rail for travel to the study area. While it also includes 256 passengers who are using a combination of commuter rail and rapid transit to reach jobs in the study area, the revenue impact of this last group of passengers was considered in Table 6.17 and is not double-counted here.

These impacts are detailed below in Table 6.19 for the 1996 Base Year.

Table 6.19

Proposed New Fenway/Kenmore Commuter Rail Station: 1996 Base Year Green Line Revenue Forecasts

Green Line Ridership Impacts	Average Revenue per Boarding	Total Change in Commuters	Daily Change in Two Way Revenue
Local study area passengers diverted by new commuter rail service	$0.70	-162	-$227
Commuter rail passengers from Back Bay to study area	$0.00	-256	0
Light rail passengers from west diverted to new commuter rail service	$0.70	-95	-$132
Green Line Totals		-513	-$359

Systemwide Revenue Impact - Estimates of the systemwide daily impacts including both the commuter rail and Green Line (rapid transit) systems for 1996, 2001 and 2010 are presented in Table 6.20. In general, it is projected that the high revenue commuter rail passenger trips attracted by the new station and service investment will generate substantial new revenues for the MBTA. These increased commuter rail revenues will be somewhat offset by reduced revenue on the rapid transit network. Since the fare for rapid transit trips is comparatively low, the net revenue impacts will be modest.

Table 6.20

Proposed New Fenway/Kenmore Commuter Rail Station: Systemwide Revenue Impact Projections

Forecast Impact	Forecast Year		
	1996	2001	2010
Commuter Rail			
Net Change in Commuter Rail Riders	564	618	735
Daily Change in Commuter Rail Revenue	$2,606	$2,855	$3,396
Green Line Rapid Transit			
Net Change in Green Line Riders	-257	-280	311
Daily Change in Green Line Revenue	-$360	-$392	-$435
Systemwide			
Daily Change in Total Revenue	$2,246	$2,463	$3,831
Weekday Parking Revenue	$75,802	$75,802	$75,802
Estimate of Change in Annual Revenue	$749,566	$814,750	$963,892

Annual revenue estimates are also presented in Table 6.20. The annual estimates were developed by multiplying average daily revenue by 300 to reflect the general weekly transit ridership patterns. Weekend and holiday ridership and revenue is generally half that of weekday ridership. Multiplying by 300 is a convenient short hand method of estimating annual totals from daily estimates that accounts for weekends and holidays. The reader should note that year 2020 annual revenue is nearly $1,000,000.

4. Impact on Study Area Traffic

A simple estimate of local roadway traffic impacts implied by the ridership projections was developed. By increasing transit ridership to the study area, automobile commuting will be reduced. If average automobile occupancy among commuters to the study area from the western suburbs is assumed to be 1.3 persons per car, the new transit service would remove approximately 525 automobiles from study area streets and parking lots.

CHAPTER 7
CAPITAL COSTS, OPERATING COSTS AND FINANCIAL EVALUATION

CAPITAL COSTS

Four significant capital investments would be required to implement full-time service to the Kenmore/Fenway area at the proposed new Fenway/Kenmore commuter rail station:

1. A longer station platform on Track Two.
2. A track crossover immediately east of Brookline Avenue.
3. Two new passenger coaches to handle increased peak ridership.
4. Additional parking spaces at the western suburban stations.

Station Platform

An expanded station would be necessary to offer full-time commuter rail service in the vicinity of the existing Yawkey Station. Service and safety considerations preclude stopping trains and having passengers board from the existing platform since it can only accommodate two passenger cars. For the purposes of this study, the minimum practical station construction has been assumed. A more elaborate station than a simple platform with provisions for access and egress by pedestrians may be built at Yawkey Station, especially as buildings are constructed beside and above the platform. However, a more elaborate station would increase capital costs significantly without generating offsetting benefits.

Figure 7.1: Existing Yawkey Station looking eastward towards Boston

RAILROAD OPERATIONS

ENGINEERING SECTION
32 Cobble Hill Road
Second Floor
Somerville, Massachusetts 02143

Fax: (617) 222-3605 *Voice: (617) 222-6178*

TO: ANN CADIGAN

FROM: DAN BAKER Phone:

DATE:

RE:

cc:

- ☐ Urgent
- ☐ For Review
- ☐ Please Comment
- ☐ Please Reply
- ☐ Per Your Request

6181

Comments:

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If you did not receive all the pages, please call telephone number above.

6/4/01 cc: D. DiZoglio
J. Congrove
S. Woelfel
C. Kerr, CTPS

No track space will be available for additional trains at the conclusion of the Fall River and Greenbush projects. Even the possible addition of four tracks on the post office site may not provide any relief for trains coming in from the Framingham line. Identification of additional trackage and a thorough evaluation of capacity at South Station should be required as part of this project.

On Page ES-7 the report says "Bridges and other segments near water would be provided with appropriate drainage systems to prevent brake dust and oil from trains from entering waterways". Is this an issue that has been raised by this community? Where else has this issue been brought up? How can brake dust be contained? Segregating drainage will require replacement of open deck bridges and installation of separator systems. Is this in the cost estimate?

On Page ES-8 the report says "The extension would be feasible from an operations standpoint." Until issues with CSX, South Station capacity, equipment servicing and mid-day layover issues are addressed it is premature to make this statement.

Where are right of way acquisition costs for a 60 mph alignment? At least three locations on this line segment have curves which appear to need land acquisitions to flatten out the curves to allow 60mph operation.

The proposed full service would have freight traffic, local service and two full express services running on the main line between Framingham and Boston. As currently configured, this means running a single track operation from CP11 to CP3 if a freight is entering or leaving Beacon Park yard. Can the existing infrastructure support this schedule? If not, additional costs should be added into this project for an additional interlocking around MP 7.

If a decision is made to construct a more elaborate station, the study team assumes that added costs would be funded separately. No estimate for the cost of additional land to build the platform was made since much of the required land is already in the public domain and owned by the Massachusetts Turnpike Authority.

The MBTA standard for station platforms is 800 feet. An 800-foot platform could be built at the current site between Beacon Street and Brookline Avenue (eastern alternative) by extending the platform beneath the Beacon Street overpass. The portion of the platform under the bridge would be narrower than standard (6 – 8 feet) but would be usable.

In order to minimize station dwell times, to provide accessibility for mobility-impaired travellers and to increase overall customer service, the MBTA requires a high-level platform on Track Two.

Extensive platform canopies at the proposed new station would be highly desirable. A single short canopy would cause delays in inclement weather, as passengers would wait under the canopy and board at the doors closest to the covered waiting areas. This would lead to increased dwell times and delays for trains in both directions. (Where portions of the station platform are built beneath the Beacon Street overpass or on any air rights development no canopy would be required.) The costs shown in this report reflect three station canopies along the length of the station platform ($100,000).

In order to move passengers efficiently from the station to their destinations, a staircase and ramping system would be provided linking the station platform to the street surface. Brookline Avenue is the main spine of the network in terms of travel and access to the rest of the Kenmore/ Fenway area. The costs shown in this report reflect the cost for a single staircase and handicapped ramping system to connect the station platform with Brookline Avenue ($250,000).

Track Crossover

To provide the maneuverability and flexibility required to serve a one-track station in double-track territory, a crossover between Back Bay Station and Brookline Avenue immediately east of Brookline Avenue would be necessary.

Since the MBTA is required to build a high-level platform, a universal crossover between Track One and Track Two would be needed. The universal crossover would benefit the freight service, allowing CSX trains to "run around" the proposed new high-level platform station. It would also allow passenger trains serving the new station to use either station track at Back Bay Station.

It is estimated that a universal crossover interlocking with required signal improvements could be constructed for $2.5 million.

Rolling Stock

Expanded service to the study area would attract additional peak passengers to commuter rail. These passengers will require seating in coaches for their trip. It has been determined that two additional bi-level passenger coaches could accommodate the increased demand.

A total of 685 new riders to the study area would result from the new station stop. There will also be 114 new riders on the line that will have diverted from the Green Line. Consequently, it is estimated that a total of 799 new commuter rail riders will need seats to and from the western suburbs. However, because the travel time to downtown Boston will increase by two to three minutes on each train due to the additional station stop, there will be a loss of 346 riders to Back Bay and South Station. This yields a net increase in ridership of 453 daily riders.

Assuming, conservatively, that 80% of the riders will use the service during the peak hours, there will be 362 new riders on the line. The MBTA's bi-level passenger coaches accommodate 182 passengers each. Two new coaches with a total capacity of 364 seats would be required to offer the new direct service to the study area. Each new coach costs the MBTA approximately $2.5 million.

Parking Requirements

In order to accommodate the increased ridership from the suburban stations, new parking spaces will need to be constructed at each station. There will be a total of 685 new riders to the study area, as mentioned above, who will need a parking space. The standard figure used to calculate the required number of spaces is 0.667 per new rider. Thus, 302 new spaces will need to be constructed, at a cost of $10,000 per plot. The construction of the parking spaces will add $3,020,000 to the capital expenditures.

There are also other costs involved in expanding the station, including lighting, signage, drainage, site preparation, and cosmetic finishes. The station construction cost estimates also include an allowance for,

- Contingencies (20%)
- Engineering & Design (7.5%)
- Field force account (2%)
- Project Administration (3.5%)

Estimates for costs of high and low platforms, station canopies, minimal vertical circulation, miscellaneous station expenses and additions are provided in Table 7.1.

OPERATING COSTS

Operating costs involved with a full-time commuter rail service to the study area fall into four different categories: fuel, transportation, mechanical and engineering/utilities. Estimated total operating costs for 2001 are summarized in Table 7.2.

Fuel Costs

Stopping and restarting at a station requires more train fuel than simply passing the station at track speed. To estimate how much more fuel would be required to serve the proposed new station every day, a train simulation tool was used to simulate a seven-car train passing the proposed station location and stopping at the station location. The difference in fuel consumption between stopping the train and running through the station is 1.44 gallons. The proposed schedule includes 38 daily trains stopping at the study area on weekdays (251 days). It is presumed that weekend service would remain at the present 18 trains on weekends and holidays (114 days). The present MBTA cost of fuel is approximately 65 cents per gallon. This yields a total fuel cost of almost $11,000.

Transportation Costs

Additional crew would be required to collect revenue from the two extra coaches. Typically a crew person is added for every two peak coaches in the train consist. For the purposes of operating cost estimation it was assumed that a single crewperson could handle the passenger attendant and revenue functions on the two new coaches[2]. Costs were estimated assuming that a new crew person would be added to the Worcester/Framingham weekday service working a 12 hour split shift with appropriate release time pay at a fully burdened cost of $263 per day. With 251 weekdays per year and a 10% allowance for vacations, sick days, training and other contingencies this yields an annual expense rate of approximately $73,000.

Mechanical Costs

The additional coaches will require maintenance. Under the new contract between the MBTA and Bay State Transit Services, the cost for additional coaches in the daily line up is charged on the basis of incremental seat-miles. Each additional seat mile is priced at $0.0106. At this rate, a coach mile using a 182 seat bi-level coach costs $1.93. The Worcester Line is 45 miles long. It is assumed that each of the two new coaches will make three round trips each weekday, one in each peak period, and one other trip. This yields a weekday total of 270 coach miles at a cost of $520.88 for each coach. It is presumed on weekends and holidays, that the additional coaches would be cut from the trains to save maintenance expense. Based on 251 weekdays per year, the estimated annual mechanical maintenance cost for the two additional coaches totals approximately $261,000.

Engineering and Utility Costs

Engineering (infrastructure) maintenance includes crossover maintenance, station cleaning, station lighting, and snow removal. It also includes electricity and other utilities at the site, policing, and other such concerns. A monthly stipend of $3,000 was assigned to cover

2 In practical reality no new staff may be required or two staff may be required depending upon how passengers and cars are distributed across trains when the service is actually implemented.

infrastructure and station maintenance. It is anticipated that utilities would cost approximately $5,000 annually. This yields an annual engineering and utility expense of $41,000 per year.

MASCO Shuttle Bus Costs

MASCO has made a commitment to meet each train that stops at the proposed new station with a shuttle bus. Assuming that there will be a 1000 passengers during the rush period, which is served by nine trains, there will be approximately 111 people per train. A standard bus can accommodate up to 55 passengers, standees included. Thus, on average, two buses will be needed to meet each train. If shuttle service is offered for the two peak periods everyday, there will be a total of 16 daily hours of service for the two buses, at a cost of $45 an hour. Based on a 251 weekday year, the annual cost to offer the shuttle service is $180,720.

Table 7.2

Estimated Operating Costs for Full-Time Commuter Rail Service to the Fenway/Kenmore Area	
Item	**Costs**
Fuel costs	$10,848
Transportation costs	$72,669
Mechanical costs	$261,484
Engineering costs	$41,000
Masco Shuttle Bus Service	$180,720
Subtotal	$566,721
Contingency @ 5%	$28,336
Administrative costs @ 10%	$56,672
Total	**$651,730**

FINANCIAL EVALUATION

Comparing the forecast operating expense with the forecast of net revenue from the proposed new service (Table 6.20) indicates that the new station and service is actually a fairly attractive transit project. The new station would generate $163,020 in annual revenues net of operating expenses in the year 2001.

With a positive operating ratio, which is rare among North American transit investments, it is possible to consider Yawkey Station as a project that could be financed privately. However, upon scrutiny, the new service would not be likely to attract private investors as a commercial undertaking. The internal rate of financial return of the project over 30 years is negative (-3.2%) assuming a $14.3 million initial capital outlay and 3% annual growth in revenue.

KKO

KKO and Associates, Incorporated
Transportation Systems Analysis
Management Consulting

Massachusetts Bay Transportation Authority

Feasibility of Full-Time Commuter Rail Service to the Fenway/Kenmore Area

Appendix A: MBTA Commuter Rail Schedules

Introduction

This appendix presents current and future planned MBTA schedules on the Framingham/Worcester line and analysis of the schedule implications of adding a station stop in the vicinity of the existing Yawkey Station. Section I contains the existing weekday schedules in mid-1999. Section II shows planned future schedules to accommodate the already-proposed station stops between Worcester and Framingham and at Mass Pike/Route 128. The planned future schedules served as the baseline for this study. Section III shows the planned future schedules adjusted to allow for full weekday service to the study area.

Section I: Current Schedules

The current schedule runs 37 daily trains on weekdays and 18 on weekends and holidays. This schedule does not include the proposed service stops at the new stations between Worcester and Framingham.

Section II: Anticipated 2010 Schedules without Service to Proposed New Fenway/Kenmore Station

The planned schedules for 2010 incorporate the expansion of service from 37 to 42 daily trains, with expanded service to Worcester. These schedules also include stops at Millbury, Grafton, Westborough, Southborough and Ashland, as well as a Mass Pike station stop.

Section III: Anticipated 2010 Schedules with Service to Proposed New Fenway/Kenmore Station

Service schedules for the proposed station were developed based on the anticipated 2010 service plans discussed above. These schedules were analyzed to determine the frequency, speed, and travel times that would be expected at the proposed station. The schedules with and without the proposed new service were compared to determine the changes in travel velocity that would occur at each suburban station when the new service is introduced. These changes in velocity were used to predict changes in ridership to Back Bay and South Station that would result by adding a new stop in the study area.

These timetables were generated using standard algorithms to calculate the acceleration and deceleration times of the train and the station dwell times required for passenger boarding and disembarking.

SECTION I: CURRENT 1999 SCHEDULES

Inbound Service

STATION	Mile Post	500 *a*	552 *b*	504 *c*	556 *d*	510 *e*	562 *f*	514 *b*	516 *a*	518 *a*	520 *c*
Worcester	44.2	S	6:15 AM S		6:45 AM S		7:45 AM S				
Framingham	21.4	6:15 AM S	6:45 AM S	7:00 AM S	7:15 AM S	8:00 AM S	8:15 AM S	8:45 AM S	10:05 AM S	12:15 PM S	2:05 PM S
West Natick	19.9	6:19 AM S	6:50 AM S	7:04 AM S	7:20 AM S	8:05 AM S	8:19 AM S	8:49 AM S	10:08 AM S	12:18 PM S	2:08 PM S
Natick	17.7	6:24 AM S	6:53 AM	7:09 AM S	7:25 AM S	8:09 AM S	8:24 AM S	8:54 AM S	10:13 AM S	12:23 PM S	2:13 PM S
Wellesley Square	14.7	6:29 AM S	6:56 AM	7:14 AM S	7:30 AM S	8:14 AM S	8:29 AM S	8:58 AM S	10:17 AM S	12:27 PM S	2:17 PM S
Wellesley Hills	13.5	6:32 AM S	6:57 AM	7:18 AM S	7:34 AM S	8:17 AM S	8:33 AM S	9:01 AM S	10:20 AM S	12:30 PM S	2:20 PM S
Wellesley Farms	12.5	6:35 AM S	6:58 AM	7:21 AM S	7:37 AM S	8:20 AM S	8:36 AM S	9:04 AM S	10:23 AM S	12:33 PM S	2:23 PM S
Auburndale	10.2	6:39 AM S	7:00 AM	7:25 AM S	7:41 AM S	8:24 AM S	8:39 AM	9:07 AM S	10:26 AM S	12:37 PM S	2:26 PM S
West Newton	9.1	6:42 AM S	7:01 AM	7:28 AM S	7:44 AM S	8:28 AM S	8:40 AM	9:11 AM S	10:29 AM S	12:39 PM S	2:29 PM S
Newtonville	8.1	6:45 AM S	7:02 AM	7:31 AM S	7:48 AM S	8:32 AM S	8:41 AM	9:14 AM S	10:33 AM S	12:42 PM S	2:32 PM S
Back Bay	1.2	6:57 AM S	7:15 AM S	7:42 AM S	8:00 AM S	8:44 AM S	8:52 AM S	9:26 AM S	10:45 AM S	12:55 PM S	2:45 PM S
South Station	0.0	7:02 AM S	7:20 AM S	7:47 AM S	8:05 AM S	8:49 AM S	8:58 AM S	9:31 AM S	10:50 AM S	1:00 PM S	2:50 PM S

Inbound Service

STATION	Mile Post	566 *b*	522 *d*	524 *b*	528 *d*	530 *a*	532 *a*	534 *a*	536 *d*
Worcester	41.2	2:05 PM S							
Framingham	21.4	2:35 PM S	3:45 PM S	5:40 PM S	6:30 PM S	7:30 PM S	9:20 PM S	11:05 PM S	12:05 AM S
West Natick	19.9	2:38 PM S	3:48 PM S	5:43 PM S	6:34 PM S	7:34 PM S	9:21 PM	11:08 PM S	12:08 AM S
Natick	17.7	2:43 PM S	3:52 PM S	5:48 PM S	6:39 PM S	7:39 PM S	9:23 PM	11:13 PM S	12:13 AM S
Wellesley Square	14.7	2:47 PM S	3:57 PM S	5:54 PM S	6:44 PM S	7:44 PM S	9:26 PM	11:17 PM S	12:17 AM S
Wellesley Hills	13.5	2:50 PM S	4:00 PM S	5:58 PM S	6:47 PM S	7:47 PM S	9:28 PM	11:20 PM S	12:20 AM S
Wellesley Farms	12.5	2:53 PM S	4:03 PM S	6:01 PM S	6:50 PM S	7:50 PM S	9:29 PM	11:23 PM S	12:23 AM S
Auburndale	10.2	2:55 PM	4:07 PM S	6:04 PM	6:53 PM	7:52 PM	9:31 PM	11:26 PM	12:26 AM S
West Newton	9.1	2:56 PM	4:09 PM S	6:05 PM	6:54 PM	7:53 PM	9:32 PM	11:27 PM	12:29 AM S
Newtonville	8.1	2:57 PM	4:12 PM S	6:06 PM	6:55 PM	7:54 PM	9:33 PM	11:28 PM	12:32 AM S
Back Bay	1.2	3:08 PM S	4:25 PM S	6:20 PM S	7:10 PM S	8:05 PM S	9:50 PM S	11:43 PM S	12:43 AM S
South Station	0.0	3:13 PM S	4:30 PM S	6:25 PM S	7:15 PM S	8:10 PM S	9:55 PM S	11:48 PM S	12:48 AM S

Outbound Service

STATION	Mile Post	501 c	505 e	507 b	509 a	511 a	565 b	513 c	515 d	519 b	571 c
South Station	0.0	5:20 AM S	7:00 AM S	7:35 AM S	9:05 AM S	11:05 AM S	12:05 PM S	1:05 PM S	2:40 PM S	4:30 PM S	4:55 PM S
Back Bay	1.2	5:25 AM S	7:05 AM S	7:40 AM S	9:10 AM S	11:10 AM S	12:10 PM S	1:10 PM S	2:45 PM S	4:35 PM S	5:00 PM S
Newtonville	8.1	5:34 AM	7:14 AM	7:49 AM	9:19 AM	11:21 AM S	12:21 PM S	1:21 PM S	2:56 PM S	4:46 PM S	5:09 PM
West Newton	9.1	5:35 AM	7:15 AM	7:50 AM	9:20 AM	11:24 AM S	12:24 PM S	1:24 PM S	2:59 PM S	4:49 PM S	5:10 PM
Auburndale	10.2	5:36 AM	7:16 AM	7:51 AM	9:21 AM	11:27 AM S	12:27 PM S	1:27 PM S	3:02 PM S	4:53 PM S	5:11 PM
Wellesley Farms	12.5	5:39 AM	7:19 AM	7:54 AM	9:26 AM S	11:31 AM S	12:31 PM S	1:31 PM S	3:06 PM S	4:57 PM S	5:13 PM
Wellesley Hills	13.5	5:40 AM	7:23 AM S	7:59 AM S	9:29 AM S	11:34 AM S	12:34 PM S	1:34 PM S	3:09 PM S	5:01 PM S	5:15 PM
Wellesley Square	14.7	5:41 AM	7:28 AM S	8:03 AM S	9:33 AM S	11:37 AM S	12:37 PM S	1:37 PM S	3:12 PM S	5:05 PM S	5:16 PM
Natick	17.7	5:44 AM	7:32 AM S	8:08 AM S	9:38 AM S	11:42 AM S	12:42 PM S	1:42 PM S	3:17 PM S	5:10 PM S	5:19 PM
West Natick	19.9	5:46 AM	7:36 AM S	8:12 AM S	9:42 AM S	11:46 AM S	12:46 PM S	1:46 PM S	3:21 PM S	5:14 PM S	5:25 PM S
Framingham	21.4	6:00 AM S	7:40 AM S	8:17 AM S	9:46 AM S	11:50 AM S	12:50 PM S	1:50 PM S	3:25 PM S	5:18 PM S	5:30 PM S
Worcester	44.2						1:20 PM S				6:00 PM S

Outbound Service

STATION	Mile Post	523 d	575 e	577 f	529 a	579 c	533 a	535 a	537 d
South Station	0.0	5:05 PM S	5:30 PM S	6:05 PM S	6:15 PM S	7:15 PM S	8:20 PM S	10:05 PM S	11:05 PM S
Back Bay	1.2	5:10 PM S	5:35 PM S	6:10 PM S	6:20 PM S	7:20 PM S	8:25 PM S	10:10 PM S	11:10 PM S
Newtonville	8.1	5:22 PM S	5:47 PM S	6:19 PM	6:32 PM S	7:32 PM S	8:36 PM S	10:21 PM S	11:21 PM S
West Newton	9.1	5:25 PM S	5:50 PM S	6:20 PM	6:35 PM S	7:35 PM S	8:39 PM S	10:24 PM S	11:24 PM S
Auburndale	10.2	5:28 PM S	5:54 PM S	6:21 PM	6:39 PM S	7:39 PM S	8:42 PM S	10:26 PM S	11:26 PM S
Wellesley Farms	12.5	5:32 PM S	5:58 PM S	6:24 PM	6:43 PM S	7:43 PM S	8:46 PM S	10:30 PM S	11:30 PM S
Wellesley Hills	13.5	5:35 PM S	6:02 PM S	6:25 PM	6:47 PM S	7:46 PM S	8:49 PM S	10:33 PM S	11:33 PM S
Wellesley Square	14.7	5:38 PM S	6:06 PM S	6:26 PM	6:51 PM S	7:50 PM S	8:52 PM S	10:36 PM S	11:36 PM S
Natick	17.7	5:43 PM S	6:11 PM S	6:29 PM	6:56 PM S	7:55 PM S	8:57 PM S	10:41 PM S	11:41 PM S
West Natick	19.9	5:48 PM S	6:15 PM S	6:35 PM S	7:00 PM S	8:00 PM S	9:01 PM S	10:46 PM S	11:46 PM S
Framingham	21.4	5:53 PM S	6:19 PM S	6:40 PM S	7:05 PM S	8:04 PM S	9:05 PM S	10:50 PM S	11:50 PM S
Worcester	44.2		6:49 PM S	7:10 PM S		8:34 PM S			

SECTION II: ANTICIPATED 2010 SCHEDULES WITHOUT PROPOSED NEW FENWAY/KENMORE STATION

Inbound Service

STATION	Mile Post	502	504	506	508	510	512	514	516	518	520	522	524	526	528	530	532	534	536	538	540	542	544	546
Worcester	44.2		6:00		6:30		7:00		7:30		8:40	10:35			14:37				17:55		19:45		22:00	
Millbury	39.3		6:08		6:38		7:08		7:38		8:48	10:42			14:44				18:02		19:52		22:07	
Grafton	36.5		6:13		6:43		7:13		7:44		8:53	10:47			14:49				18:07		19:57		22:12	
Westborough	33.9		6:18		6:48		7:18		7:49		8:58	10:52			14:54				18:12		20:02	20:44	22:17	
Southborough	27.1		6:27		6:58		7:28		7:58		9:07	11:01			15:03				18:21		20:11	20:52	22:26	
Ashland	24.5		6:32		7:03		7:33		8:04		9:12	11:05			15:07				18:25	19:00	20:15	20:57	22:30	
Framingham	21.4	6:10	6:38	6:50	7:09	7:20	7:39	7:45	8:09	8:30	9:18	11:11	12:08	14:08	15:13	16:10	17:30	18:06	18:31	19:05	20:21	21:03	22:36	23:20
West Natick	19.9	6:13		6:54		7:24		7:49		8:33	9:21	11:15	12:11	14:11	15:17	16:13		18:09		19:09	20:25	21:07	22:40	23:23
Natick	17.7	6:17		6:58		7:28		7:53		8:37	9:26	11:19	12:15	14:15	15:21	16:17	17:36	18:13		19:13	20:29	21:11	22:44	23:27
Wellesley Square	14.7	6:23		7:04		7:34		7:59		8:43	9:31	11:24	12:20	14:20	15:26	16:22	17:41	18:18		19:18		21:16		23:33
Wellesley Hills	13.5	6:26		7:07		7:37		8:02		8:46	9:34	11:27	12:23	14:23	15:29	16:25		18:21		19:21		21:20		23:36
Wellesley Farms	12.5	6:29		7:10		7:40		8:05		8:49	9:37	11:30	12:26	14:26	15:32	16:28		18:24		19:24		21:23		23:39
MassPike	11.3	6:32	6:51	7:14	7:22	7:44	7:52	8:09	8:23	8:53	9:41	11:34	12:30	14:30	15:36	16:32	17:47	18:28	18:44	19:28	20:38	21:26	22:53	23:43
Auburndale	10.2	6:35			7:25		7:55		8:26	8:56		11:37	12:33	14:33	15:39				18:47			21:29		23:46
West Newton	9.1	6:38			7:29		7:59	8:14		9:00		11:40	12:36	14:36	15:42				18:51			21:32		23:49
Newtonville	8.1	6:41			7:32		8:02	8:17		9:03		11:43	12:39	14:39	15:45				18:54			21:35		23:51
Yawkey	2.3																							
Back Bay	1.2	6:52	7:07	7:29	7:44	7:59	8:13	8:28	8:40	9:14	9:56	11:55	12:50	14:50	15:55	16:47	18:01	18:42	19:05	19:43	20:52	21:45	23:07	0:02
South Station	0.0	6:57	7:12	7:34	7:49	8:04	8:18	8:33	8:45	9:19	10:01	12:00	12:55	14:55	16:00	16:52	18:06	18:47	19:10	19:48	20:57	21:50	23:12	0:07

Outbound Service

STATION	Mile Post	501	503	505	507	509	511	513	515	517	519	521	523	525	527	529	531	533	535	537
South Station	0.0	7:20	7:35	9:00	11:00	12:00	13:05	15:10	16:20	16:33	16:55	17:03	17:30	17:40	18:05	18:15	19:15	20:15	22:15	23:15
Back Bay	1.2	7:25	7:40	9:05	11:05	12:05	13:10	15:15	16:25	16:38	17:00	17:08	17:35	17:45	18:10	18:20	19:20	20:20	22:20	23:20
Yawkey	2.3																			
Newtonville	8.1				11:16	12:16	13:21	15:26		16:49		17:19		17:56		18:31	19:31	20:31	22:31	23:31
West Newton	9.1				11:18	12:19	13:24	15:29		16:52		17:22		17:59		18:34	19:34	20:34	22:34	23:34
Auburndale	10.2				11:22	12:22	13:27	15:32		16:55		17:26		18:03		18:37	19:37	20:37	22:37	23:37
MassPike	11.3	7:40	7:55	9:20	11:25	12:25	13:30	15:35	16:40	16:59		17:30	17:50	18:07	18:25	18:40	19:40	20:40	22:40	23:40
Wellesley Farms	12.5		7:58	9:23	11:28	12:28	13:33	15:38		17:03		17:33		18:10		18:44	19:43	20:43	22:43	23:43
Wellesley Hills	13.5		8:01	9:26	11:31	12:31	13:36	15:41		17:06		17:36		18:13		18:47	19:46	20:46	22:46	23:46
Wellesley Square	14.7		8:04	9:30	11:34	12:34	13:39	15:44	16:46			17:40		18:17		18:51	19:49	20:49	22:49	23:49
Natick	17.7		8:09	9:35	11:39	12:39	13:44	15:49	16:51			17:45	17:59	18:22		18:56	19:54	20:54	22:54	23:54
West Natick	19.9		8:13	9:39	11:43	12:44	13:49	15:53	16:56			17:50	18:03	18:27	18:36	19:00	19:59	20:59	22:59	23:59
Framingham	21.4	7:52	8:17	9:43	11:46	12:48	13:53	15:58	17:00	17:17	17:26	17:55	18:07	18:31	18:41	19:05	20:03	21:03	23:03	0:03
Ashland	24.5	7:57		9:49		12:53			17:06		17:32		18:13	18:38	18:46	19:10	20:08	21:08		0:08
Southborough	27.1	8:01		9:53		12:58			17:10		17:37		18:18		18:51	19:15	20:13	21:13		0:13
Westborough	33.9	8:10		10:02		13:07			17:19		17:46		18:27		19:00	19:23	20:22	21:22		0:22
Grafton	36.5	8:15		10:06		13:11			17:24		17:51		18:32		19:05	19:28		21:26		0:26
Millbury	39.3	8:20		10:11		13:16			17:30		17:56		18:38		19:10	19:33		21:31		0:31
Worcester	44.2	8:28		10:20		13:25			17:40		18:05		18:46		19:18	19:42		21:40		0:40

SECTION III: ANTICIPATED 2010 SCHEDULES WITH FULL SERVICE TO PROPOSED FENWAY/KENMORE STATION

Inbound Service

STATION	Mile Post	502	504	506	508	510	512	514	516	518	520	522	524	526	528	530	532	534	536	538	540	542	546
Worcester	44.2		5:58		6:28		6:57		7:28		8:39	10:34			14:34				17:57		19:42		
Milbury	39.3		6:06		6:36		7:05		7:36		8:47	10:41			14:41				18:04		19:49		
Grafton	36.5		6:11		6:41		7:10		7:42		8:52	10:46			14:46				18:09		19:54		
Westborough	33.9		6:16		6:46		7:15		7:47		8:57	10:51			14:51				18:14		19:59	20:41	
Southborough	27.1		6:25		6:56		7:25		7:56		9:06	11:00			15:00				18:23		20:08	20:49	
Ashland	24.5		6:30		7:01		7:30		8:02		9:11	11:04			15:04				18:27	18:59	20:12	20:54	
Framingham	21.4	6:07	6:36	6:48	7:07	7:17	7:36	7:42	8:07	8:27	9:17	11:10	12:05	14:05	15:10	16:20	17:29	18:08	18:33	19:04	20:18	21:00	23:18
West Natick	19.9	6:10		6:52		7:21		7:46		8:30	9:20	11:14	12:08	14:08	15:14	16:23		18:11		19:08	20:22	21:04	23:21
Natick	17.7	6:14		6:56		7:25		7:50		8:34	9:25	11:18	12:12	14:12	15:18	16:27	17:35	18:15		19:12	20:26	21:08	23:25
Wellesley Square	14.7	6:20		7:02		7:31		7:56		8:40	9:30	11:23	12:17	14:17	15:23	16:32	17:40	18:20		19:17		21:13	23:31
Wellesley Hills	13.5	6:23		7:05		7:34		7:59		8:43	9:33	11:26	12:20	14:20	15:26	16:35		18:23		19:20		21:17	23:34
Wellesley Farms	12.5	6:26		7:08		7:37		8:02		8:46	9:36	11:29	12:23	14:23	15:29	16:38		18:26		19:23		21:20	23:37
Mass Pike	11.3	6:29	6:49	7:12	7:20	7:41	7:49	8:06	8:21	8:50	9:40	11:33	12:27	14:27	15:33	16:42	17:46	18:30	18:46	19:26	20:35	21:23	23:40
Auburndale	10.2	6:32			7:23		7:52		8:24	8:53		11:36	12:30	14:30	15:36				18:49			21:26	23:43
West Newton	9.1	6:35			7:27		7:56	8:11		8:57		11:39	12:33	14:33	15:39				18:52			21:29	23:46
Newtonville	8.1	6:38			7:30		7:59	8:14		9:00		11:42	12:36	14:36	15:42				18:55			21:31	23:49
Yawkey	2.3	6:47	7:02	7:24	7:39	7:54	8:08	8:23	8:35	9:09	9:51	11:50	12:45	14:45	15:50		17:58	18:42	19:04	19:38	20:47	21:40	23:57
Back Bay	1.2	6:51	7:06	7:29	7:44	7:59	8:13	8:28	8:40	9:14	9:56	11:55	12:49	14:50	15:55	16:57	18:03	18:47	19:09	19:43	20:52	21:44	0:02
South Station	0.0	6:57	7:12	7:34	7:49	8:04	8:18	8:33	8:45	9:19	10:01	12:00	12:55	14:55	16:00	17:02	18:08	18:52	19:16	19:48	20:57	21:50	0:07

Outbound Service

STATION	Mile Post	501	503	505	507	509	511	513	515	517	519	521	523	525	527	529	531	533	535	537
South Station	0.0	7:20	7:35	9:00	11:05	12:05	13:05	15:05	16:20	16:33	16:55	17:03	17:30	17:40	18:05	18:18	19:15	20:15	22:15	23:15
Back Bay	1.2	7:25	7:40	9:05	11:10	12:10	13:10	15:10	16:25	16:38	17:00	17:08	17:35	17:45	18:10	18:23	19:20	20:20	22:20	23:20
Yawkey	2.3				11:14	12:14	13:14	15:14	16:30	16:43	17:05	17:13	17:40	17:50	18:15	18:28	19:24	20:24	22:24	23:24
Newtonville	8.1				11:22	12:22	13:22	15:22		16:51		17:22		17:59		18:36	19:32	20:32	22:32	23:32
West Newton	9.1				11:25	12:25	13:25	15:25		16:54		17:25		18:02		18:39	19:35	20:35	22:35	23:35
Auburndale	10.2				11:28	12:28	13:28	15:28		16:58		17:28		18:05		18:42	19:38	20:38	22:38	23:38
MassPike	11.3	7:40	7:55	9:20	11:32	12:32	13:32	15:32	16:42	17:02		17:32	17:52	18:09	18:27	18:46	19:42	20:42	22:42	23:42
Wellesley Farms	12.5		7:58	9:23	11:35	12:35	13:35	15:35		17:05		17:36		18:13		18:49	19:45	20:45	22:45	23:45
Wellesley Hills	13.5		8:01	9:26	11:37	12:38	13:38	15:38		17:08		17:39		18:16		18:53	19:48	20:48	22:48	23:48
Wellesley Square	14.7		8:04	9:30	11:40	12:41	13:41	15:41	16:48			17:42		18:19		18:56	19:51	20:51	22:51	23:51
Natick	17.7		8:09	9:35	11:45	12:46	13:46	15:46	16:54			17:48	18:01	18:25		19:02	19:56	20:56	22:56	23:56
West Natick	19.9		8:13	9:39	11:49	12:50	13:50	15:50	16:58			17:52	18:06	18:29	18:38	19:06	20:00	21:00	23:00	0:00
Framingham	21.4	7:52	8:17	9:43	11:53	12:54	13:54	15:54	17:03	17:19	17:29	17:57	18:10	18:33	18:43	19:10	20:04	21:04	23:04	0:04
Ashland	24.5	7:57		9:49		13:00			17:08		17:34		18:16	18:41	18:48	19:16	20:10	21:10		0:10
Southborough	27.1	8:01		9:53		13:04			17:13		17:39		18:21		18:53	19:20	20:14	21:14		0:14
Westborough	33.9	8:10		10:02		13:13			17:22		17:48		18:30		19:02	19:29	20:23	21:23		0:23
Grafton	36.5	8:15		10:06		13:18			17:27		17:53		18:35		19:07	19:34		21:28		0:28
Milbury	39.3	8:20		10:11		13:22			17:33		17:59		18:40		19:12	19:38		21:32		0:32
Worcester	44.2	8:28		10:20		13:31			17:42		18:07		18:49		19:21	19:47		21:41		0:41